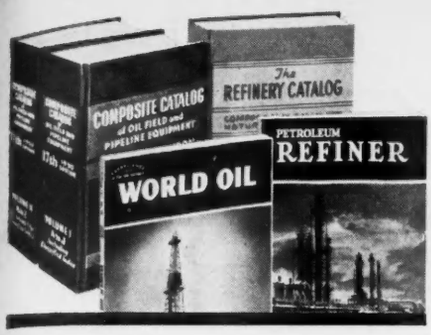

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for the refining-natural gasoline industry

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Current Outlook Section

L. J. LOGAN, SECTION EDITOR

WORLD OIL

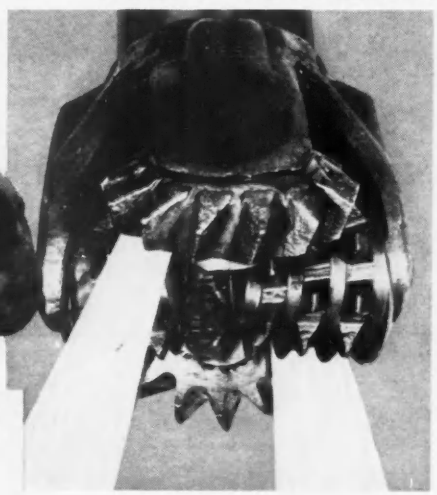
REED Liquid-blast ROCK BITS

G. G. (Pinky) Jordan, tool pusher for Richardson & Bass Drilling Company, Louisiana, says . . .

This bit drills fast without balling up.

"I like to use **REED** "LT" Series Rock Bits for Louisiana drilling because I can make footage fast without having the bit ball up."

REED LIQUID-BLAST JETTING ACTION KEEPS CUTTERS CLEAN



This photograph shows how jets of drilling fluid from the Liquid-Blast nozzle clean both the cutters and the bottom of the hole.

This action permits "crowding" the bit for fast soft-formation drilling without having formation ball up on the cutters.

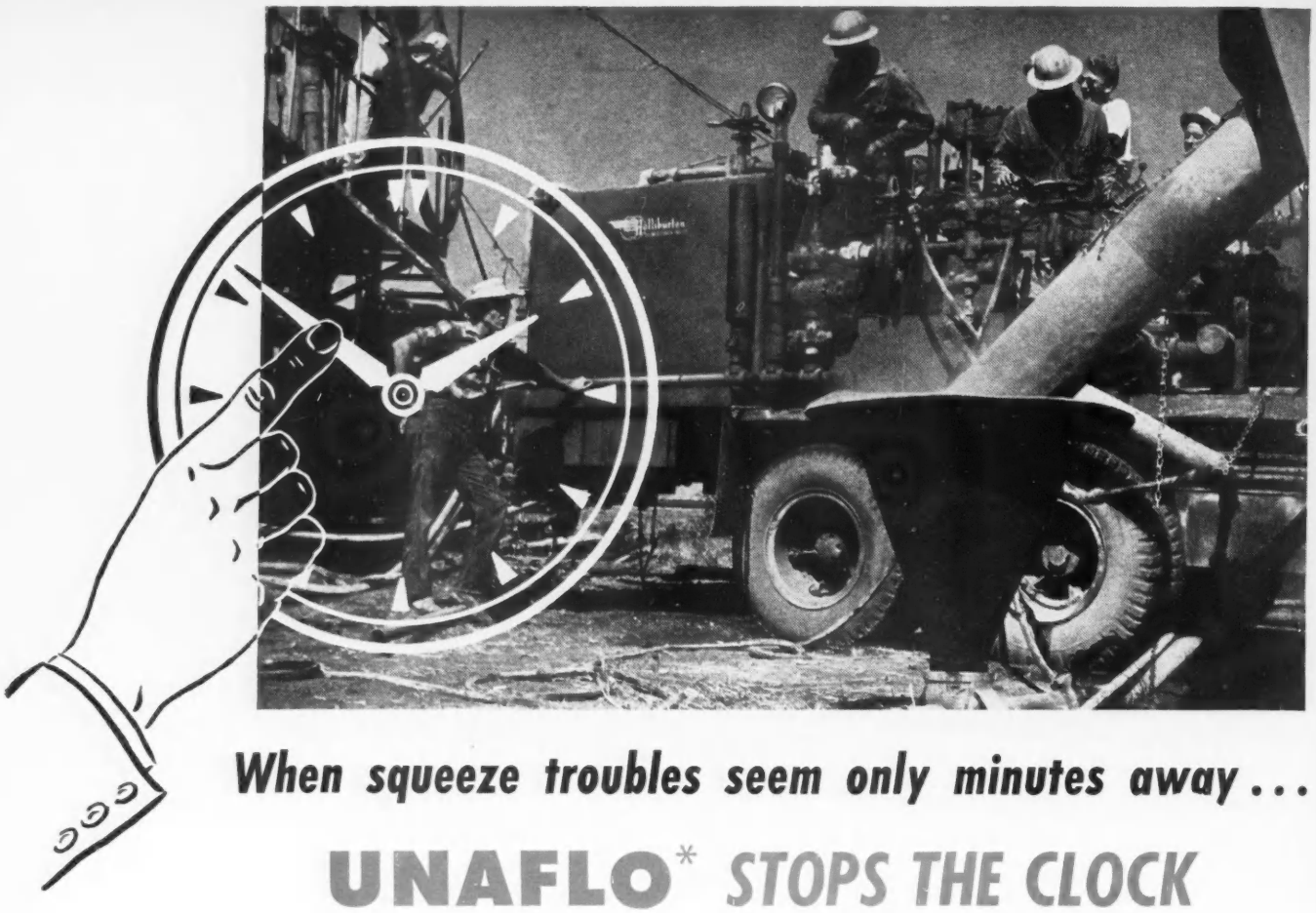
FOR GOOD LONG RUNS USE THE REED "LB"

REED ROLLER BIT COMPANY

HOUSTON 1, TEXAS

Gulf Coast, Mid-Continent, Rocky Mountain and Canadian Distributor for Martin-Decker Products

R THE MARK OF QUALITY



When squeeze troubles seem only minutes away...

UNAFLO* STOPS THE CLOCK

WHEN you're squeezing deep down a hot hole... and delays crop up... Unaflo gives you vital extra time. Why? Because Unaflo is a *retarded* cement —not merely "slow-setting." It stays fluid and pumpable throughout the retardation period and allows more time to complete the job.

This safety factor of Unaflo has been proved in the laboratory (see chart) and in the field—where pressures over 4,000 p.s.i. combine with temperatures above 100°F.

On your next squeeze job, use Unaflo. It will protect your investment three ways:

EASY FLOWING—Unaflo's high *initial* fluidity makes pumping easier.

SUSTAINED FLUIDITY—Unaflo *stays* fluid and pumpable throughout the retardation period. There's ample time, even in emergencies, to get the cement in place.

HARDENS NORMALLY—Unaflo, after its retarded period, makes a *strong* tight seal—resistant to sulfate waters.

Helpful free bulletin gives facts-and-figures comparison of Unaflo's well-bottom performance with that of other cements. For your copy write: Universal Atlas Cement Company (United States Steel Corporation Subsidiary), 100 Park Avenue, New York 17, N. Y.

LABORATORY TESTS SHOW UNAFLO'S DELAYED, RETARDED SET

Stanolind Pressure Thickening—Time Tester

Thickening time—40% mixing water. Slurry weight: 16.5 lb./gal.

Tests made by Universal Atlas Research Laboratories in accordance with methods of API Code 32, 2nd edition, 6/50.

WELL CONDITIONS			Viscosity in Poises at time (Hrs.-Min.) Indicated								Thick. Time Hr.-Mn.
Well Depth (Ft.)	Max. Temp. °F.	Max. Pressure-psi	0	0:15	0:30	1:00	1:30	2:00	3:00	4:00	
6000	113.0	3867	6	8	8	10	10	10	24	77	4:03
8000	125.0	5156	6	7	8	8	8	15	45		3:15
10000	144.0	7484	7	7	6	6	7	8	63		3:03
12000	172.0	10227	11	11	12	12	11	18			2:31
14000	206.0	13386	10	11	11	14	17	20			2:25
16000	248.0	16144	9	9	10	11	19				1:41
18000	300.0	18800	8	8	8	8	47				1:33

"UNAFLO" is the registered trade mark of the retarded oil-well cement manufactured by Universal Atlas Cement Company

WACO • KANSAS CITY • BIRMINGHAM • CHICAGO • NEW YORK • Export Distributor: United States Steel Export Co., New York

Universal Atlas Cement Company

OIL-FIELD CEMENTS

Unaflo *Retarded* Oil-Well Cement
Resistant to Sulfate Waters
Atlas Portland Cement—Type I

Atlas Portland Cement—Type II
Resistant to Sulfate Waters
Atlas High-Early Cement—Type III

WO-U-123

"THE THEATRE GUILD ON THE AIR"—*Sponsored by U. S. Steel Subsidiaries—Sunday Evenings—NBC Network*

Looking Ahead

REGISTRATIONS AT API ANNUAL MEETING in Chicago November 5-8 likely will set record. Highest so far was 5246 at Chicago in 1948, a record not quite equaled at Chicago in 1949 or Los Angeles in 1950. (Information on meeting: Page 354.)

MORE INFLATION is in prospect. Wages are steadily going higher. Increasing amounts are being spent on war goods, stimulating money supply and circulation. As more materials go into war production, shorter supplies remain for civilian goods. Shortages are indicated for 1952 in many lines, especially when present large inventories disappear.

SPRABERRY SAND OF WEST TEXAS may be productive over area exceeding 1 million acres. In fact, 1 million acres already are considered semi-proved, while 500,000 acres are believed to be definitely proved. In late September, 522 wells in 16 separate areas over several counties were prorated to 48,560 barrels daily average production.

UNDER 40-ACRE SPACING, development of 1 million acres of Spraberry production would require 25,000 wells. As this would involve about 4.5 million tons of steel, some operators have proposed 80-acre spacing rule. They say this would save 2.25 million tons of steel as well as other materials, money, and manpower. This suggestion and others for Spraberry development are being studied by nine-man committee representing several hundred operators.

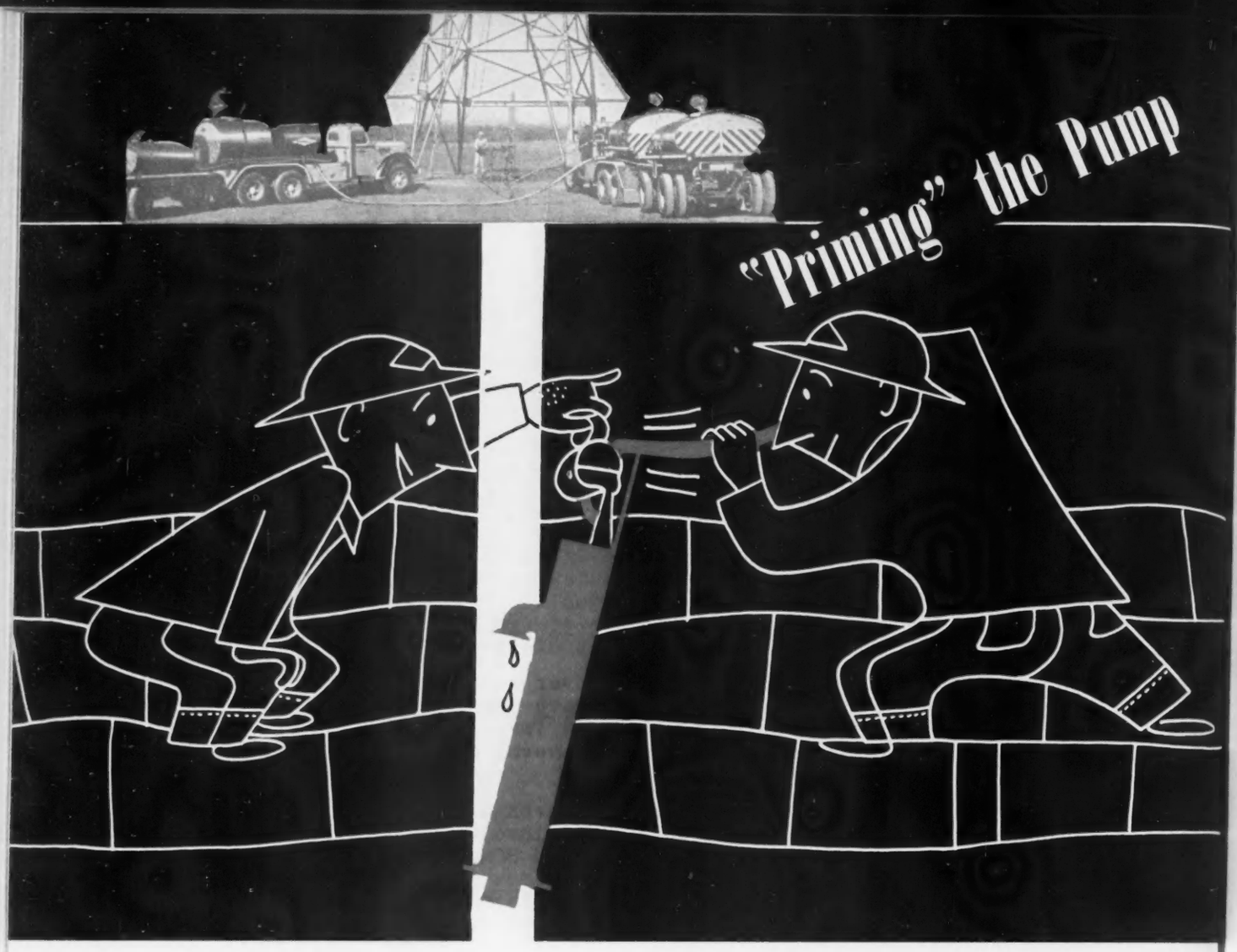
STEEL WILL CONTINUE SCARCE IN 1952. Oil industry will get tubular goods for drilling about same number of wells as in 1951. It will be provided better share of line pipe to permit building oil pipe lines as outlets for flush fields with pent-up producing ability. Shortage of line pipe for natural gas pipe lines will become more acute. Aluminum, copper, zinc, and tin will be in short supply outside direct military use.

HOPES OF OIL INDUSTRY for lifting of price controls are generated by predictions that next several months may bring removal of ceilings on some things, such as those already priced below ceilings, notions and other goods of small consequence, and items like beef that are hard to control. Oil producers declare crude prices must increase from their frozen, pre-Korea levels to cover after-Korea increases in costs of materials and labor. Otherwise, it is claimed, there will be less incentive than needed to assure discovery and development of adequate crude reserves and oil supplies.

U. S. CRUDE PRODUCTION will be reduced substantially in November. Cuts in daily allowables in Texas and Louisiana aggregate 115,841 barrels, including 98,184 for Texas and 17,657 for Louisiana. This is first cut in year for Texas. Reduction for Texas reflects efforts to hold down gas waste in West Texas and less urgent demand for U. S. oils in replacement of shutoff supplies from Iran.

ADDITIONAL 400,000 BARRELS PER DAY of high quality motor fuel could be made in U. S. by condensing available natural gas with known methods. This potential is beginning to be used in tractors, trucks, and busses. In 1950 over 100,000 farm tractors were converted to natural gas liquids, and many city bus systems are purchasing new equipment to use these fuels.

REGISTRATIONS OF AUTOMOBILES, TRUCKS AND BUSSES for 1951 are estimated by Bureau of Public Roads at 52,199,000, an increase of 6.2 percent over the 49,143,275 of 1950. Automobiles registered in 1951 will total 42,846,000, a gain of 6.3 percent over 40,315,175 in 1950. Trucks and busses will increase to 9,353,000 from 8,828,100, a rise of 5.9 percent.



PRODUCTION POTENTIAL INCREASED because Dowell XM Acidizing Service reduced silicate swelling

Dowell Acidizing Service offers you the benefit of 19 years of extensive research and the experience gained in over 100,000 acidizing jobs! When you "Look to Dowell" you get the *right* acidizing treatment in your completion or work-over program.

For example, Dowell's experience has shown that some silicates, those of the clay mineral type found in certain dolomite and limestone producing formations, swell during conventional acid treatments. This silicate swelling not only delays the clean-up of the well after acidizing, thus increasing rigtime, but also can actually reduce oil production. Dowell research tackled the problem and solved it. Now, Dowell XM acid . . . which contains special chemical agents to control silicate swelling . . . is available to you for the profitable acidizing of formations known to contain such silicates.

A well completed in a Permian lime formation, known to contain swelling silicates, tested natural at 65 barrels of oil per day. Although acidizing treatments on comparable wells in the area had never given a potential over 100 barrels of oil per day, a 2000 gallon Dowell XM acid treatment produced a potential of 300 BOPD!

Today, Dowell is still pioneering new techniques and new materials to bring you advanced methods for completing and reworking oil and gas wells. When you need an expert acidizing job, call on Dowell to give you the best. There is a Dowell station near you.

DOWELL, INCORPORATED
TULSA 3, OKLAHOMA
Subsidiary of The Dow Chemical Company

DOWELL
ACIDIZING SERVICE

Ask your nearest Dowell station for complete information on these Dowell services and products: Acidizing Service, Electric Pilot Services, Plastic Service, Chemical Scale Removal Service for heat exchange equipment, Jelflake, Paraffin Solvents, Magnesium Anodes for Corrosion Control and Bulk Inhibited Hydrochloric Acid.

"First in Acidizing . . . since 1932"

Look to DOWELL

FOR OIL INDUSTRY CHEMICAL SERVIC

Editor's Page

WILDCATTERS—THE AMERICAN HOPE

IN A TIME when far too many Americans are content to permit their precious liberties to be taken from them in exchange for what they think is security, it is heartening to realize that there still are men who retain enough faith in the future and also have the courage and inspiration to undertake hazardous and costly business ventures in the face of unrelenting socialistic trends. This is the very lifeblood which makes the U. S., for this spirit is responsible for the constant industrial growth which has made this country. It has provided new jobs, more production, new wealth, new purchasing power, and a higher standard of living for all the people. Should this nation ever stop creating new business units it will perish just as surely as if it stopped producing children.

• • •

IN THESE TIMES, when the trend toward a welfare state is moving forward at such speed as to be frightening, the courage and hope of the people should be bolstered materially by the presence of those who have not yet wilted under the strain. Outstanding among the events which currently demonstrate that men of daring and vision still exist in this country is the continuing search for new oil producing fields on a greatly accelerated scale.

• • •

IN THE FACE of higher taxes and an increase in dry holes until one-third of all drilling operations in 1950 were failures, wildcat drilling rates have more than doubled since the war. Finding of new fields is the lifeblood of the U. S. oil industry. Whenever petroleum discovery efforts decline, the oil industry will begin to fade away. From the wildcatters' efforts stem new prosperity to various communities, providing a new measure of health, comfort and security to many people.

• • •

THE IMPORTANCE, however, of such enterprises goes far beyond the immediate environments of their effect on the oil industry, local communities and general economy. They stand out as a shining light of hope that this country will remain invincible — against the military might of foreign aggressors as well as against all socialistic schemes from within the nation itself.

• • •

FAR MORE IMPORTANT to the future of America than even its mighty industrial capacity is the maintenance of the driving force of enterprise and creative energy, supported by the daring and technical skill of free competitive men. If this fundamental spirit of Americanism is not to be destroyed—and the country along with it—it will be due to the existence of men typified by oil wildcatters. These are the men of great indestructible faith, who undaunted by the frustrations of failures continue to stand up boldly and defiantly through crisis after crisis in these grave times.

• • •

IF MEN OF SUCH characteristics are given a gambling incentive, they will remain with us forever. This will keep alive the greatest single factor responsible for the progress and welfare of this country.

Warren L. Baker

here's the plug

proved best by thousands of runs

Truth of the saying "Nothing succeeds like success" is outstandingly proved by the BAKER RETAINER BRIDGE PLUG! The "well proved" design—based upon the long famous Baker Cement Retainer—has performed successfully in countless thousands of wells—for every purpose—at all temperatures—and at all depths.

IDEAL FOR EVERY PURPOSE

For new well completions, work-overs, testing, squeeze jobs, well abandonments, and many other installations, you can be sure of fast, efficient, economical results with the Baker Model "K" Retainer Bridge Plug—Product No. 400.

The design of the plug affords ample clearance for fast, safe running-in, and the slips set quickly and positively. The packing element is held in sealing position by lead seals; packs off against all differential pressures; and prevents movement of fluid or gas either up or down the well. There is no need to place cement above the Baker Retainer Bridge Plug to effect a perfect seal, but, if desired, you can dump cement *on the same run* by using a Baker Model "B" Dump Bailer.

YOUR CHOICE OF TWO EASILY DRILLABLE TYPES

For temporary service, choose the Baker MAGNESIUM ALLOY Type Bridge Plug; for permanent installations, specify the CAST IRON Type which is stronger than the casing, and will outlast the casing if harmful well fluids are a problem. Either type drills up in record time because the drilling bit contacts the *very minimum* cross-sectional area; the *short over-all length* reduces drilling time; and the *segmented cast iron slips* are quickly broken up with cable tools, or a rotary bit.

CHOOSE YOUR SETTING METHOD

A BAKER BRIDGE PLUG (Product No. 400) can be set on tubing or drill pipe (in the same manner as the well known Baker Cement Retainer) but in these days of pipe shortages we suggest that you contact your choice of the leading wire line service organizations for setting a Baker Bridge Plug (Product No. 400-D) on an electrical conductor cable. You can thus avoid wear and tear on your tubing, and worthwhile savings of time result from wire line setting, particularly in deeper wells.

ARE YOU USING THE BAKER ADVISORY SERVICE?

Why not call the Baker representative in your area and discuss with him installation of a Baker Bridge Plug? You will find that he has valuable knowledge and helpful suggestions to solve your problems.

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RETAINER BRIDGE PLUG

The Changing Panorama

Let's Tell Gas Facts to Public

NATURAL GAS producers still hesitate to sell gas in interstate markets. They fear possibility of federal control, despite the 4 to 1 decision of the Federal Power Commission, declining to assert control over producers such as Phillips Petroleum Company. This decision probably will be appealed to the courts.

While advocates of control for producers promise the public more gas at lower prices, their activities actually are conducive to less gas at higher prices. Because of the threat of regulation of producers' activities and prices, an artificial barrier has been raised between the consumer and the producer, impeding the free flow of natural gas from the producing to the consuming states.

The price that the consumer pays for natural gas actually could be affected only slightly even by substantial improvement of the heretofore too-low prices received by producers. In Wisconsin, for instance, the average domestic consumer pays from $1.43 to $2.18 per thousand cubic feet for natural gas, for which the producer receives only 8.1 cents. Even if the price at the well were doubled —which is quite unlikely at any time in the near future—the additional cost to the consumer on this score would be only 3½ to 5½ percent.

The principal problem heretofore in regard to price of natural gas at the well has been one of price too low to cause operators to want to complete gas wells and put them into production. The surest way for consumers to be provided with adequate supply of natural gas is for the price to the producer to improve and remain free to respond to conditions of demand and supply.

Possibilities for excessive price payable to the producer are virtually ruled out, with natural gas production scattered as it is among thousands of producers, and with each well having market limited by accessibility to natural gas pipe line outlet.

Natural gas producers fortunately do not have to sell in the interstate market and lay themselves open to regulations as a utility. Forced to do so by the danger of federal control, they may sell their gas at home instead of selling it for export from the state.

In ten years, the petrochemical industry in the gas producing states of Arkansas, Louisiana, Oklahoma, and Texas has grown into a billion dollar enterprise. These states now have 720 chemical plants that use natural gas.

Present and prospective domestic consumers of natural gas therefore must bid against these petrochemical and other users of gas for available supplies. From the domestic consumers' standpoint, it is short-sighted and foolish to quibble with the producer over the wellhead price of the gas, especially at present, when this price still is far below real value.

If federal regulation of gas production and federal fixing of wellhead prices of gas should be put into effect, consumers everywhere undoubtedly would be hurt.

In its own interest, the American public should demand of Congress special legislation specifically exempting natural gas production and gathering from federal regulation, so as to remove any threat of such control being attempted by a power-hungry government.

However, the public does not know or understand these facts, and it is the job of the oil and gas industries to make them known.

Human Relations of Major Importance

ALL OIL industry employes who aspire to managerial positions as well as those who now occupy such posts will do well to recognize the great importance of promoting favorable employe relations and a clear understanding by employes of economic facts and the ways in which a modern business functions. It is now a major responsibility of managers to keep things running smoothly and efficiently by keeping employes well informed and happy in their work.

Five out of six employes now work for others, leaving just one out of six self-employed. Formerly, only two out of five worked for others and three out of five were self-employed. We are now in a "laboristic" period, and legislators know it and are making laws in accordance with the wishes of the job-holding majority. This is a fundamental trend that makes it imperative for management to strive to make available to employes good pay, attractive benefits, and desirable working conditions.

While thus working in the interest of employes, management must at the same time strive hard to gain and hold the understanding and cooperation of workers, to the end that the workers will understand clearly how American business functions and will reject communistic and other destructive ideas and proposals.

Men in charge of public relations and employe relations for oil companies now are giving special attention to several important things.

- They are attaching much importance to communications, seeking thorough spreading of facts, information, and ideas among all people in their organizations so that there will be better understanding between all groups and individuals.
- Systematic training of managers and employes is being fostered.
- Emphasis is being placed on safety in human relations programs.
- The importance of benefits for employes is recognized, especially since the U. S. Supreme Court has ruled that benefits are properly a matter for consideration in collective bargaining.

To the credit of the petroleum industry, it must be said that it is doing a generally fine job of giving proper attention to all these important special matters. Also, it has consistently maintained wage scales well above the average. The industry has been, and is, commendably progressive in its employe relations, and since World War II has been overcoming an earlier shortcoming by actively and systematically promoting better public relations, informing its customers and the public about its achievements, progressiveness, efforts, and problems.

Men of the industry will be wise to maintain and even intensify efforts to promote favorable employe and public relations.

Report from the Observatory

UNCERTAIN ECONOMIC PICTURE AHEAD

By RAY L. DUDLEY, Publisher, and WARREN L. BAKER, Editor

UNCERTAIN CONDITIONS face the oil industry during the next few months. Trends should be watched very closely so refining and producing rates can be adjusted quickly to fit possible rapid changes which would affect the economic outlook.

With winter months now at hand, the industry has entered its most important consuming portion of the year and also its most unpredictable season because uncontrollable weather has so much to do with demand volumes. This winter, however, represents an especially unknown problem because the industry also is plagued by other uncertain factors such as military demand, Korean peace talks, higher export rates due to the Iranian situation, and unforecastable import rates. Any of these could quickly reverse themselves, and as long as they remain unsettled it is impossible to make a valid forecast for the coming winter.

• • •

NO ONE KNOWS whether military operations are likely to increase or slacken, and either action would influence the oil situation. Furthermore, the foreign oil situation looms larger on the horizon of the U. S. industry. It must be assumed that Iranian oil and products again will be available to compete in world markets, but no one knows when. Sharply increased output in Saudi Arabia and Kuwait have largely replaced the loss of Iranian production, but this poses the problem of what will be done with the enlarged world oil production when Iranian oil becomes available. If world oil output is to be balanced with demand, a return of Iranian oil would make it necessary that production in other countries be cut back voluntarily, particularly in the Middle East and Venezuela.

The Iranian shutdown since July has resulted in a slight reduction in U. S. import rates and a jump of more than 100 percent in total exports. This has acted as a brake on total inventory buildup in the U. S., despite higher production and refining rates the past three months.

The 98,000-barrel per day cutback in Texas' November oil production allowable offers encouragement that stocks will not run away during the coming months, but the effects of this reduction may be more than offset by a decline in exports. A sharp drop in exports during November and December is indicated by the announcement that Asiatic Petroleum Corporation, largest buyer of U. S. exported oils, has filled its 1951 requirements. Moreover, the rapid buildup of European refinery capacity, with a number of plants recently completed and others in the completion stage, indicates strongly that world dependence on U. S. petroleum may diminish.

The question of imports also enters the picture, with renegotiation of the U. S.-Venezuela agreement coming up. The U. S. Tariff Commission and its Committee for Reciprocity Information now are studying the limits to which reduced tariffs might be applied without threatening serious injury to the domestic industry. Larger imports would occur under reduced tariffs, particularly if the world supply should exceed requirements, as would result from Iran returning to production or lessened military demand.

• • •

ONE THING IS CERTAIN—a cold winter is needed to absorb the unusually large U. S. distillate fuel oil stocks accumulated since last spring. This situation presages the desirability for refiners to cut back refinery runs from record levels of recent months, and it was encouraging to note a tendency in this direction during October.

Stocks of distillate fuel oil are at levels which could become excessive almost overnight, and any sudden downward trend in demand or surge in supply could have serious reactions for the industry.

Distillate fuel oil stocks reached an all-time peak of 101½ million barrels on October 20, up 6⅓ million barrels from a month ago and 18½ million barrels greater than a year ago. A delay in arrival of cold weather could bring further increases, probably resulting in an outbreak of price reductions at the retail level.

• • •

ONE BRIGHT SPOT in the present picture is the sharp improvement in motor fuel stocks in recent months. The 111⅓ million barrels of gasoline in storage October 20 were nearly 2 million under month ago volumes and only 6 million barrels above year ago levels, whereas they had been 10 million larger one month previous and 12½ million above 1950 quantities in mid-July.

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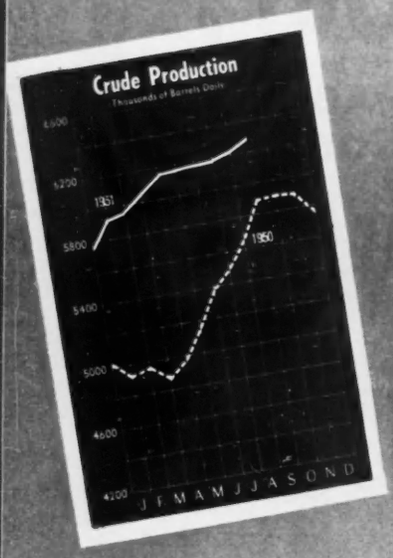
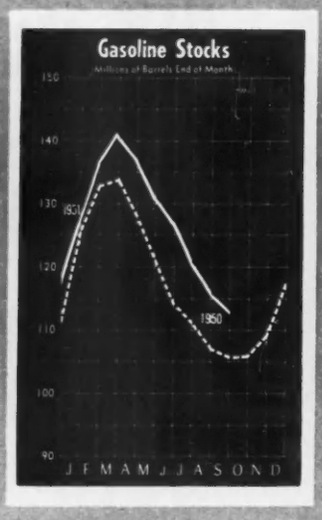
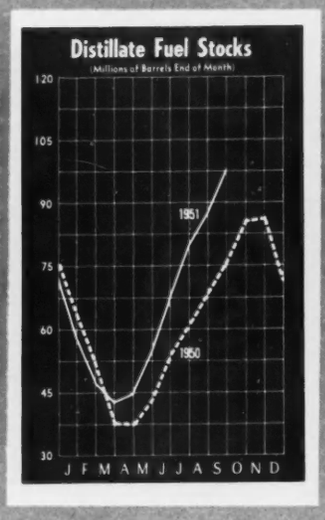
VALVES • FITTINGS • PIPE • PLUMBING • HEATING

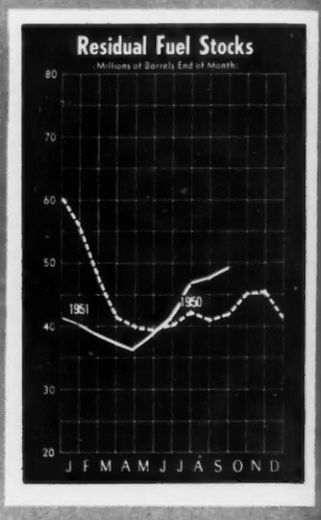
Petroleum

By CECIL W. SMITH,









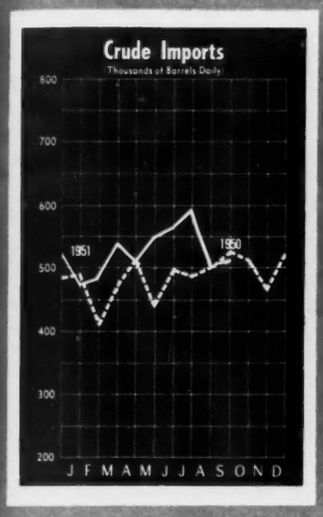
U. S. Crude Production by States

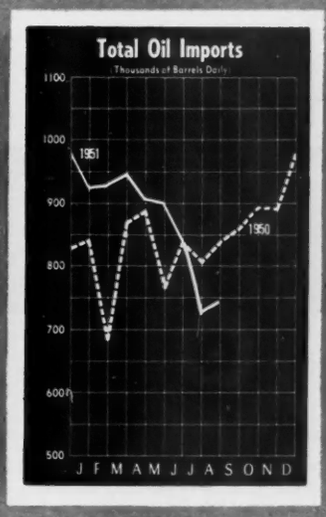
(THOUSANDS OF BARRELS)

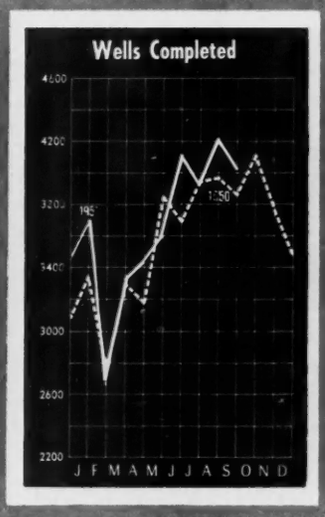
STATE or DISTRICT	DAILY AVERAGE PRODUCTION				TOTAL PRODUCTION First Nine Months		
	September, 1951	August, 1951	September, 1950	% Diff. Sept., '51-'50	1951	1950	% Diff. '51-'50
Alabama	3.0	3.0	2.2	+ 36.4	785	500	+ 57.0
Arkansas	81.7	81.5	85.5	— 4.5	22,291	23,407	— 4.8
California	981.7	978.6	921.9	+ 6.5	264,435	239,732	+ 10.3
Colorado	78.1	77.2	63.9	+ 22.2	20,304	16,592	+ 22.4
Florida	1.7	1.6	1.6	+ 6.3	444	343	+ 29.4
Illinois	168.4	170.6	173.2	— 2.8	44,563	46,605	— 4.4
Indiana	31.0	32.0	28.0	+ 10.7	7,680	7,418	+ 3.5
Kansas	320.4	321.0	307.1	+ 4.3	85,445	79,756	+ 7.1
Kentucky	31.8	30.9	30.6	+ 3.9	8,159	7,481	+ 9.1
Louisiana	655.7	641.2	596.7	+ 9.9	173,542	153,326	+ 13.2
North Louisiana	125.2	127.0	118.2	+ 5.9	32,997	33,202	— 0.6
South Louisiana	530.5	514.2	478.5	+ 10.9	140,545	120,124	+ 17.0
Michigan	38.2	37.9	42.2	— 9.5	10,601	12,043	— 12.0
Mississippi	102.0	104.1	109.8	— 7.1	27,937	28,424	— 1.7
Missouri	0.1	0.1	0.1	.....	19	21	— 9.5
Montana	25.7	26.1	22.3	+ 15.2	6,766	6,000	+ 12.8
Nebraska	6.5	6.3	5.7	+ 30.0	1,933	856	+125.8
New Mexico	144.0	145.7	136.6	+ 5.4	38,887	35,622	+ 9.2
New York	13.9	14.1	11.4	+ 21.9	3,317	3,116	+ 6.5
North Dakota	.....	.....	.....	.....	3	.....	.....
Ohio	7.9	8.9	9.1	— 13.2	2,362	2,553	— 7.5
Oklahoma	505.8	506.5	485.4	+ 4.2	138,472	119,314	+ 16.1
Pennsylvania	28.3	28.5	33.7	— 16.0	8,407	8,827	— 4.8
Tennessee	0.1	0.1	.....	.....	10	16	— 37.5
Texas	2,866.7	2,811.1	2,635.9	+ 8.8	747,229	595,986	+ 25.4
Dist. 1—South Central	33.8	33.7	30.7	+ 10.1	9,064	7,592	+ 19.4
Dist. 2—Middle Gulf	169.6	164.5	150.5	+ 12.7	44,476	35,198	+ 26.4
Dist. 3—Upper Gulf	508.6	495.7	453.5	+ 12.1	134,649	108,896	+ 23.6
Dist. 4—Lower Gulf-S.W.	263.6	261.4	234.6	+ 12.4	69,560	55,536	+ 25.3
Dist. 5—East Central	57.2	55.9	44.0	+ 30.0	14,205	9,315	+ 52.5
Dist. 6—Northeast	397.7	390.2	407.9	— 2.5	106,185	96,081	+ 10.5
Dist. 7-B—North Central	83.7	82.0	75.0	+ 11.6	22,419	18,415	+ 21.7
Dist. 7-C—West Central	115.0	110.5	66.2	+ 73.7	27,465	15,820	+ 73.6
Dist. 8—West	993.0	971.3	923.9	+ 7.5	253,470	188,145	+ 34.7
Dist. 9—North	159.7	159.9	156.4	+ 2.1	42,243	38,855	+ 8.7
Dist. 10—Panhandle	84.8	86.0	91.4	— 7.2	24,085	24,873	— 3.2
Utah	3.7	3.7	3.2	+ 15.6	1,005	874	+ 15.0
Virginia	0.1	0.1	.....	.....	13	16	— 18.8
West Virginia	7.7	7.7	7.7	.....	2,068	2,134	— 3.1
Wyoming	186.1	188.8	174.1	+ 6.9	51,172	43,986	+ 16.3
Total United States	6,290.3	6,277.3	5,887.9	+ 6.8	1,667,849	1,434,948	+ 16.2

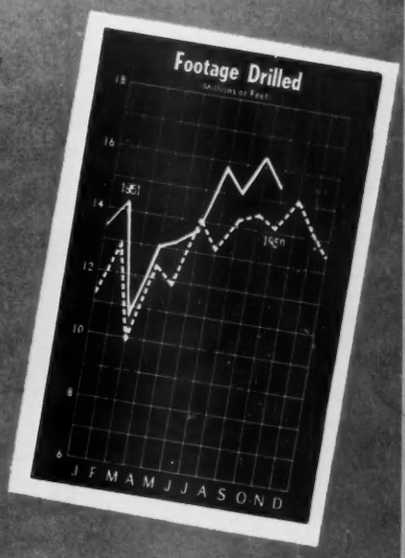
Trends in U. S.

WORLD OIL Staff





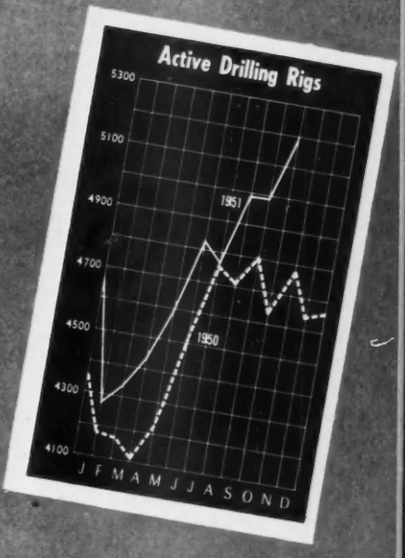


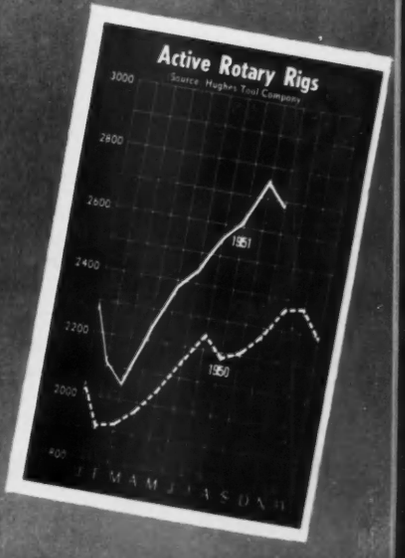


Crude Oil and Refined Products Trends

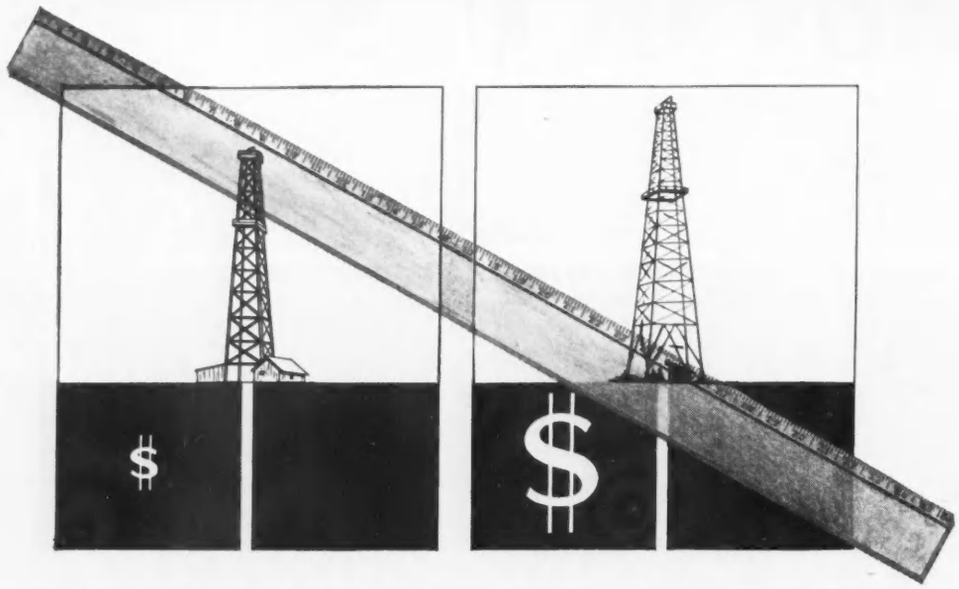
(THOUSANDS OF BARRELS)

MONTH	CRUDE OIL			GASOLINE		DISTILLATE FUEL		RESIDUAL FUEL		DAILY IMPORTS	
	Production Daily	Runs to Stills Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Production Daily	Stocks End of Month	Crude Oil	Total Oils
1949:											
September.	4,940	5,427	251,689	2,617	101,799	1,002	83,213	1,110	67,117	374	623
October...	4,997	5,373	250,932	2,643	103,287	1,001	90,643	1,141	68,673	492	785
November.	5,210	5,293	256,010	2,594	104,707	962	88,212	1,180	65,112	435	703
December.	5,024	5,475	253,356	2,633	111,521	1,032	75,207	1,203	60,193	485	828
1950:											
January...	4,922	5,483	246,610	2,575	125,298	1,048	63,932	1,209	55,808	487	841
February..	4,967	5,316	243,750	2,552	132,796	1,026	52,206	1,172	47,828	411	684
March....	4,878	5,336	241,098	2,539	133,766	938	37,777	1,154	41,860	471	869
April....	4,968	5,193	244,605	2,508	128,057	977	37,530	1,048	39,979	511	888
May.....	5,143	5,535	239,877	2,647	121,035	997	42,739	1,063	39,482	439	766
June.....	5,378	5,655	242,287	2,748	114,074	1,037	53,679	1,069	40,124	498	838
July.....	5,484	5,882	240,270	2,835	111,055	1,040	62,555	1,140	42,165	486	806
August....	5,665	6,067	237,393	2,932	107,067	1,089	68,426	1,148	40,979	501	839
September.	5,888	6,059	242,311	2,849	105,748	1,180	78,270	1,178	41,966	525	859
October...	5,900	6,077	246,424	2,875	105,764	1,217	85,643	1,250	45,004	510	896
November.	5,891	6,085	250,016	2,859	109,005	1,218	86,113	1,240	45,048	466	891
December.	5,758	6,092	247,814	2,872	117,220	1,307	70,875	1,280	41,184	521	979
1951:											
January...	5,907	6,450	243,107	2,962	128,479	1,427	58,424	1,368	40,317	499	977
February..	5,930	6,562	235,247	2,906	137,243	1,419	47,587	1,382	39,409	468	937
March....	6,052	6,469	233,824	2,908	141,456	1,327	42,978	1,348	37,516	483	861
April....	6,127	6,183	243,180	2,821	139,188	1,171	44,736	1,230	36,910	511	871
May.....	6,170	6,436	248,418	3,031	132,261	1,210	55,273	1,265	39,317	518	876
June.....	6,130	6,575	248,170	3,100	127,595	1,254	67,839	1,277	41,566	563	876
July.....	6,141	6,462	250,847	3,091	121,482	1,228	79,437	1,275	45,163	546	788
August....	6,277	6,545	252,144	3,112	115,306	1,273	87,034	1,243	47,476	498	725
September.	6,290	6,590	255,307	3,097	112,653	1,298	97,983	1,220	47,956	517	741
Sept. 1951 Change:											
In Month.	+13	+45	+3,163	−15	−2,653	+25	+10,949	−23	+480	+19	+16
In Year...	+402	+531	+12,996	+248	+6,905	+118	+19,713	+42	+5,990	−8	−118
Week Ended:											
10-13-51..	6,329	6,426	254,434	3,047	112,000	1,257	100,190	1,199	49,139	471	791
10-14-50..	5,862	6,124	241,117	2,870	103,807	1,268	80,959	1,210	42,910	447	792





BY ANY YARDSTICK...CEMENTING PRICES ARE LOW



DRILLING COSTS

Writing in a leading oil journal, a production executive of one of the world's largest oil companies makes the statement that "the average well-drilling costs have more than doubled in the last 10 years." The increase, he says, is the result of higher wages, higher investment costs of equipment, higher cost of materials and supplies, and the greater average depth of wells.

Although affected by the same conditions, the price of cementing has risen only slightly in the same period and is, in fact, lower today than it was in 1924.

By any yardstick, Halliburton cementing prices are low.

Erle P. Halliburton

Chairman of the Company
HALLIBURTON OIL WELL CEMENTING CO.
Duncan, Oklahoma

Monthly News Analysis

API Talks Highlight Petroleum in Defense

Special problems caused by the current vast national defense program of the U. S. will be among those considered by the petroleum industry at the forthcoming 31st annual meeting of the American Petroleum Institute at Chicago, November 5-8.

The industry must take a leading role in present day national defense, as demonstrated strikingly in World War II. It supplies not only fuels but also other vitally needed products for direct military use, including aviation gasoline, fuels for tanks, trucks, and other military equipment, butadiene for synthetic rubber, toluene for explosives, greases, chemicals, and so on. These things are supplied to the military while the industry also must continue to supply vast civilian needs for petroleum products, in furthering defense production, agriculture, and other essential civilian activities.

Because it has so much responsibility in connection with national defense, the petroleum industry is entitled to have much to say and do with regard to carrying out the present defense program. Unless it does assert its views on the proper conduct of the program, particularly as it affects petroleum, the industry will not be living up to its responsibilities. And at the annual meeting of the API there will be a good opportunity for crystallizing industry thinking on the problems raised by present national defense efforts.

Among the new subjects worked into the program for this year, in this connection, is that of the protection of petroleum facilities. A session on this important matter has been scheduled, featuring papers by Ned H. Dearborn, president of the National Safety Council, Chicago; Vice Admiral Merlin O'Neill, commandant of the U. S. Coast Guard; and Rear Admiral B. B. Biggs (U.S.N.) of the Munitions Board.

At the general sessions, one of the principal addresses will be that of General of the Army Omar N. Bradley, chairman of the Joint Chiefs of Staff. Governor Allan Shivers of Texas also will make one of the featured addresses.

Of special interest at this meeting will be the election of a new chairman of the board of directors to succeed W. Alton Jones, who is now completing the second of the two one-year terms permitted by the Institute's by-laws.

Independents Ask Action On Crude Price Situation

Price ceilings of crude must be adjusted to bring them more in line with the general economy, the nation's independent oil men declared in passing a resolution calling on the OPS for immediate action.

More than 1000 delegates to the 22nd Annual Independent Petroleum Association of America meeting in Houston October 22-23 heard discussion of the crude price situation, synthetic fuels, the tubular goods shortage, and other pressing problems facing the independent.

While the average price of oil in the past four years has not increased, but has slightly decreased, it was pointed out that the wholesale price index for all commodities has increased about 13 percent since the beginning of the Korean war.

The government's synthetic liquid fuels program also came in for close examination. Since the domestic oil industry has ably demonstrated its ability to continue necessary expansion by increasing its productive capacity 50 percent during the past five years, the IPAA officially resolved to oppose the subsidization in any form of the fuel economy of the nation or a synthetic liquid fuel industry. It also opposed the federal government's owning, operating, or otherwise engaging in or controlling commercial synthetic liquid fuel plants.

The independents asked for a distribution method for tubular goods that will assure equitable access to all materials in short supply without preferential treatment based on customer relationship.

IPAA's Economics Committee forecast average demand for crude in the U. S. during 1952 will be about 7,774,000 barrels daily. The figure is based on assumption of a status quo situation, with continuation of a high level of industrial activity geared to a defense economy, normal weather conditions, no new international developments, and a continuation of the Iranian shutdown. The 1952 forecast compares with a demand of about 7,677,000 barrels daily, estimated for the fourth quarter of 1951.

Delegates to the annual meeting heard Lieut. Gen. Ernest O. Thompson and Olin Culberson, both of the Texas Railroad Commission; J. Ed Warren, past president of IPAA; Clarence Manion, Dean of Law, Notre Dame University; Minor S. Jameson, Jr., assistant to the president of IPAA; J. Warren Kinsman, vice president, E. I. duPont de Nemours; Allen B. Kline, president of the American Farm Bureau Federation; and Texas Senator Lyndon B. Johnson.

Charlton H. Lyons, Shreveport, was elected the 1952 president of IPAA, succeeding Warren.

Platte Line An Example Of Oil's Great Benefits

The petroleum industry takes some capital and with it generates additional capital or wealth, thereby building up the country and helping to make it busy and prosperous. A good example of this will be seen in the active development in prospect for the Rocky Mountain area on completion next year of the crude pipe line of Platte Pipe Line Company.

The 100,000 barrels of oil per day that the line will carry to Eastern markets will generate $150,000 per day of capital in the hands of Rocky Mountain operators. Most of this will be spent in searching for and producing even more oil in the Rocky Mountains, which in turn will generate still more capital.

The Rocky Mountain province is so vast and its petroleum possibilities so attractive that it will be a long time before the operators begin to siphon off capital to other areas, pointed out Millard K. Neptune, president of the new pipe line company, organized last year by Sinclair Oil & Gas Company, The Ohio Oil Company, The Pure Oil Company, The British-American Oil Company and Continental Oil Company. The line will extend from Worland, Wyo., to Wood River, Ill., and is scheduled for completion in late summer of next year.

As an oil producing area, said Neptune, the Rocky Mountain region is just beginning to flex its muscles.

Higher Demand May Offset Heavy Heating Oil Stocks

There is anxiety at present over record breaking stocks of heating oils, which threaten to become burdensome and depress the market. But there is also in prospect a very large demand for these oils. Domestic demand has continued to increase sharply, and export demand has been strongly stimulated, at least temporarily, by requirements in replacement of supplies withheld from the world markets by Iran.

For the fourth quarter of 1951, total demand for distillate fuel oil has been forecast by the U. S. Bureau of Mines at 1,522,000 barrels daily, an increase of 180,000 barrels a day, or 13.4 prcent, over the demand in the final quarter of 1950. Domestic demand is expected to show an increase of 10.8 percent and exports to be more than double those in last year's last three months. U. S. stocks of distillate fuel oil as of October 20, 1951, totaled 101,548,000 barrels, and were 18,702,000 barrels or 22.6 percent in excess of the 82,846,000 barrels held October 21, 1950. The 13.4 percent increase in demand, though large, is not enough to justify this 22.6 percent expansion of stocks.

The continuing strong demand for heating oil is based on some important advantages offered by this fuel, despite competition from coal and gas. Especially conducive to good demand is the fact heating oil has continued very economical to use, besides being a clean and convenient fuel. While the price of many commodities has increased more than 100 percent since 1940, the retail price of domestic fuel oil has advanced only 78 percent. Coffee has gone up 281 percent, butter 127 percent, round steak 221 percent, and the index base for all food 131 percent.

On a per dollar cost for heat furnished, fuel oil is substantially cheaper to use than any other fuel in most areas in the Middle Atlantic states and in other areas of large requirements for heating fuels. Also, three other facts make oil heating thrifty and satisfactory. (1) Through constant research, the petroleum industry has improved the quality of fuel oil. (2) Oil burner efficiency has been improved by engineering advances. (3) Fuel oil dealers have educated a large percentage of families in having their oil burners adjusted and serviced regularly, with the result that the most efficient year-around operation is secured.

Government Controls Parade In Uniform of U. S. Defense

"IN ORDER to promote the national defense" is an innocent sounding phrase that is making its appearance more frequently during the present emergency period as the preamble to directives, regulations, and orders of government bureaus and as the basis of planners' plans for private industry.

Some regulations by government agencies are necessary to fill essential military needs and to distribute critical materials properly among manufacturers and users. But many directives and proposals of government bureaucrats, taking advantage of broad powers in the Defense Production Act, have more far-reaching significance. In the guise of national defense, the federal government threatens to make deep inroads toward control of private industry.

Foot In Our Door

Within the past few weeks two moves in this direction have been made in Washington, both of which could put the federal foot in the oil industry's back door, at least, and provide the opening for making the government a permanent house guest. The more long-ranged of these is the request of Secretary of the Interior Oscar L. Chapman for approval of two plants for manufacture of liquid fuels from coal and shale. Despite the opposition of the National Petroleum Council and a strong protest from some members of his own Petroleum Administration for Defense, Chapman has requested the government, under the Defense Production Act, to authorize $455 million in "borrowing power" to get the program underway. That amount includes $400 million for a coal hydrogenation plant and $55 million for an oil shale plant.

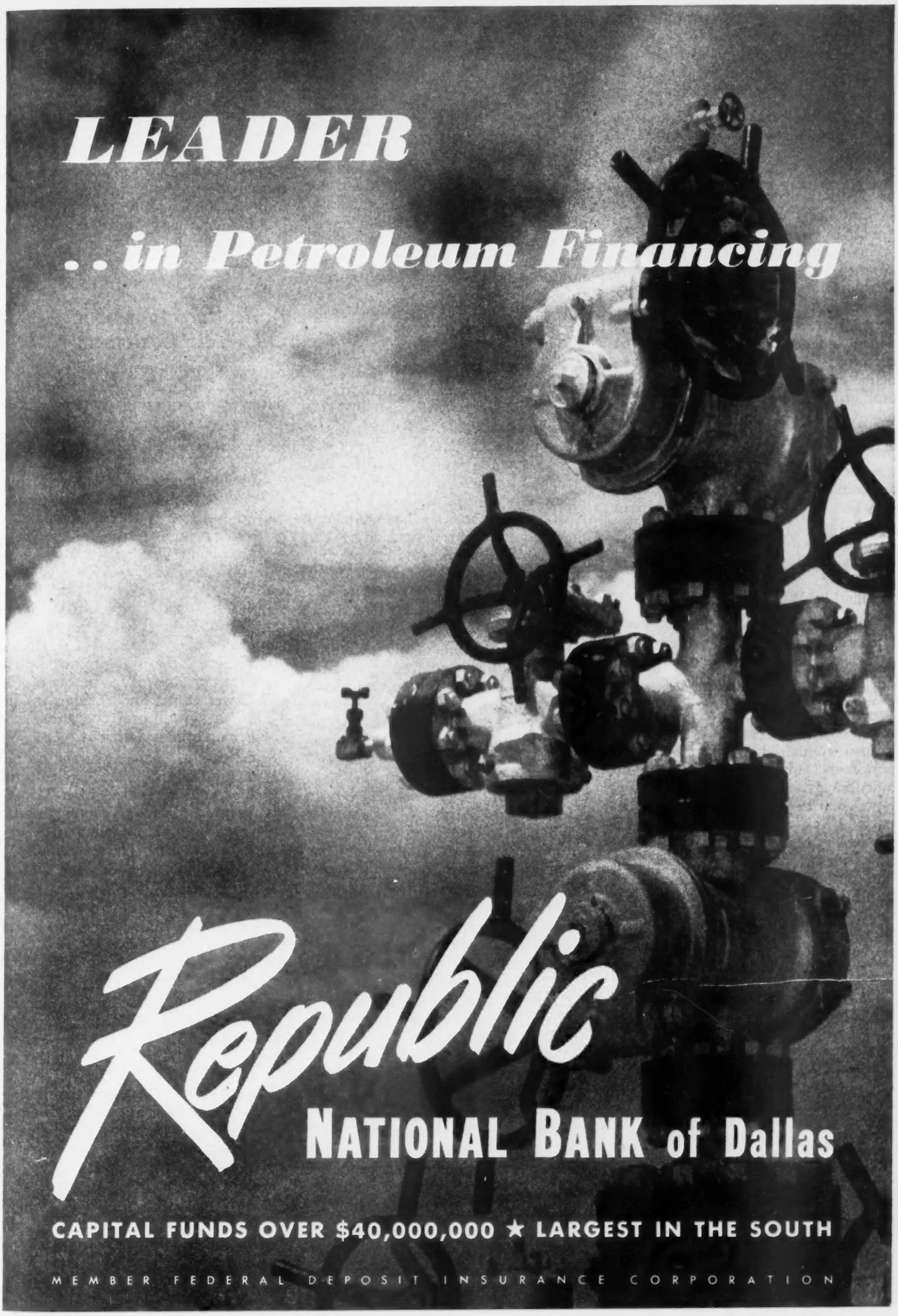
In line with this government plan, Ferdinand Eberstadt and Company, a New York investment banker, has proposed that its newly-formed subsidiary, Colchem Corporation, build a multi-million dollar coal hydrogenation plant to produce liquid fuels and essential chemicals. This offer is made provided the federal government will guarantee the builder minimum prices on the products involved. That's where the requested $400 million in "borrowing power" would come in.

This would be similar to price supports under agricultural commodities, meaning in the case of gasoline that if prices dropped below current market quotations set by competitive free-enterprise oil companies—each trying to produce the best product at the lowest cost—the government would then step in and subsidize the synthetic producer to keep his gasoline competitive—at taxpayers' expense. Though government support of such a plant would come under the "in order to promote national defense" angle, the ardent backers of synthetic fuels in the Bureau of Mines are the first to admit that construction of a large-scale synthetic fuels plant could not be started before 1953, and it is estimated 2½ years would be required to build it.

Industry experts and some government officials condemn such a proposal on the grounds of waste of heat energy in the hydrogenation process, the drain on steel and manpower to build such facilities, and the questionable economics of producing both chemicals and liquid fuels from coal when these are now being produced economically from petroleum in sufficient quantity. Another strong argument is that when commercial hydrogenation is developed so that the liquid fuel produced will cost less than present petroleum-derived products, the petroleum industry will be ready to jump into synthetic production.

Regulations vs. Orders

A regulation of more immediate consequence to the oil industry came from PAD, entitled Regulation 1. (This is not to be confused with PAD Order No. 1 which came out last February allocating tetraethyl lead to refiners. The difference between a regulation and an order is not quite clear, but the issuance of both are "found necessary and appropriate to promote the national defense.") The preamble of PAD Regulation 1 states: "Consultation with industry representatives in advance of the issuance of this regulation has been rendered impracticable by the fact that the regulation applies to all in-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dividuals in the oil and gas industries and to those supplying to such industries other products which are within the jurisdiction of the Petroleum Administration for Defense."

While "impracticable" to consult with industry about the regulation, it spells out a broad control by PAD over the industry, stated as:

"The Petroleum Administration for Defense may, from time to time, issue directives requiring, forbidding, or otherwise providing for the receipt or use of petroleum or other products by any person or persons or the delivery of petroleum or other products to any person or persons. Where a directive, or an amendment or supplement thereto, is issued, it shall take precedence over the provisions of any general order, regulations, direction, or other action of the Petroleum Administration for Defense, over the provisions of *any contract* to which any person, to whom the directive amendment or supplement is issued, may be a party and *over* the provisions of any *rate schedule, tariff, regulation or order of any regulatory body, including regulatory bodies of the several states and territories.*" (Italics supplied by WORLD OIL.)

According to PAD officials, such authority as outlined will be used only as a last resort, but the authority of virtually absolute powers over the petroleum industry is spelled out. When PAD issued Order No. 2, limiting extensions of natural gas service to new industrial and house-heating customers, an act of Congress—an amendment to section 704 of the Defense Production Act—was hastily passed. This measure greatly limited the powers of PAD under the order in states where a public regulatory agency had authority to restrict the use of natural gas and certified to the President that it would exercise that authority to accomplish the objectives of the order.

So far PAD has acted only once under Regulation 1. It directed four major refiners to supply 2,100,000 barrels of Navy Special fuel oil during October, November, and December, and directed 14 companies to supply on a pro rata basis Grade C fuel oil to the primary suppliers, to make up deficits caused by the diversion of production to Navy special fuel.

No provision is made for customers who have contracts with these plants, and such contracts possibly could be set aside by the PAD regulation. If these regulations should disrupt normal supplier-customer relations, it could then be declared that there existed a need for complete allocation of oil—and that would entail more orders "in order to promote the national defense."

End of Shortage Caused By Iranian Shutdown Seen

The shortages of crude oil and refined petroleum products caused by stoppage of production and refining in Iran are being gradually relieved. The deficiency is being partially compensated through completion of additional refining capacity in western Europe and boosting crude production in Kuwait, Saudi Arabia, and other Middle East areas.

The U. S. has been contributing materially toward making up the shortage, having boosted exports of refined products more than 100,000 barrels per day above former levels, with crude production and refinery runs at record levels. Venezuela has stepped up crude production to the highest levels in history, and refineries of the Caribbean area have similarly increased their throughput. The Far East also is supplying additional oils for the world market, taking care of some Asiatic customers that formerly used products from the Abadan refinery.

Heretofore, some of the oils that the markets have required in replacement of Iranian oils apparently have been coming necessarily from storage in Europe and elsewhere. For it seems doubtful that serious shortages have been averted altogether through stepped up current production. If European and other stocks have been drawn down sharply, as indicated, it will be necessary to replenish them, and this will mean continued strong demand on the new sources of supply.

In any event the U. S. is expected to have to continue making relatively heavy shipments of refined products abroad during the remainder of this year and well into 1952. However, earlier estimates that the U. S. would have to contribute about 460,000 barrels a day toward the world deficit during the rest of 1951 have been revised downward, and it is now reported that only about 280,000 barrels a day will be required for this purpose.

Even this is an important amount, and the Petroleum Administration for War has encouraged state regulatory agencies to authorize allowables continuing crude production close to the high levels of the recent past. However, some reductions in quotas have been ordered for November in Texas and Louisiana.

It is believed that even though stocks of crude or products rise in October and November, requirements in 1952 will justify such a buildup.

The only serious problem remaining as a result of the Iran shutdown is that of aviation gasoline. U. S. military demands have piled heavy requirements on American industry that only drastic measures can fulfill. In late October, a new series of orders to the industry in this connection was expected.

Agriculture Is Among Oil's Best Customers

An important responsibility of the petroleum industry is that of anticipating and meeting the needs of agriculture, which is becoming an increasingly large consumer of products made from petroleum.

Changes in methods of producing the nation's food and fibre have moved America's farmers and ranchers into position as the largest users of petroleum products, the Texas Mid-Continent Oil & Gas Association was reminded by Ladd Haystead, New York agricultual counselor and writer. Speaking on the subject, "What's Ahead for Petro-Agriculture?" he also predicted that the next decade will see nearly a million fewer farms and ranches in the U. S., as agricultural operations become increasingly efficient.

Less than 20 percent of the people of the U. S. now are agricultural producers, as compared with 25 percent ten years ago. Tractors in use increased from 1 million to nearly 4 million units in the same period.

Farm families have progressed from their former mode of life, with its hard work and lack of conveniences, to a situation that compares favorably with and often excels city life, by virtue of modern conveniences and general efficiency.

The petroleum industry is an important supplier of products now required by farmers and ranchers, including fuels, greases, fertilizers, insecticides, and other things. The industry generally realizes the importance of the agricultural market and is doing a good job of supplying it. Likewise, manufacturers of agricultural equipment are well serving the farmers and ranchers.

The remarkable efficiency of American agriculture thus is largely the result of working together on the part of the farmers, farm equipment manufacturers, and the petroleum industry, as supplier of fuels and chemicals.

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Year's Completions Head for New Peak

DRILLING activity in the U. S. remained high during September, resulting in 4078 completed wells with a combined total of 15,478,782 feet in depth. Those totals did not make the month a record-breaker, for August still holds that claim with more than 4300 wells and almost 16½ million feet of hole, but they did hold September considerably above the average for 1951 or any other year.

September's drilling contribution to the year's total boosted it to 33,510 completed tests, which was a 3.4 percent advantage over activity during the comparable period of last year. Last year at the same time the nation's drillers had completed 32,393 wells, and they continued the pace to make 1950 the most active drilling year in the industry's history. However, the current year's drilling is certain to reach a new peak.

In the first nine months, 127,271,090 feet were drilled in this year's wells, amounting to an increase of 8.6 percent over the 117,234,298 feet recorded by the end of September, 1950. Each new well drilled so far this year has averaged 3852 feet in depth, while during the same period of last year the average to which each well was drilled was 3666 feet.

Four of the top six drilling states in the nation have been the scenes of increased activity this year compared with 1950. Texas' 13,569 wells represented a gain of 8.4 percent over the 12,519 recorded in last year's first nine months. Oklahoma with 4167 wells showed an increase of 4.5 percent, and Kansas upped its activity by 9 percent by drilling 3114 tests. California in drilling 1804 wells gained 28.2 percent over last year's 1407.

Well Completions in the United States During September, and First Nine Months, 1951

(Figures compiled by WORLD OIL Staff from private reports and other souces as follows: Illinois from Illinois Geological Survey; Indiana from Indiana Division of Geology; Missouri from Missouri Geological Survey; Tennessee from Tennessee Division of Geology; Bradford, Kane-Clarendon and Allegany fields of Pennsylvania and New York from the *Producers Monthly*.

State or District	MONTHLY COMPLETIONS, SEPTEMBER, 1951 — NEW WELLS: Oil	Dist.	Gas	Dry	Water Input	Gas Input	Water Disposal	Total New	Total Drilled Deeper	TOTAL COMPLETIONS: Sept., 1951	Aug., 1951	Sept., 1950	Footage Sept., 1951	CUMULATIVE TOTALS January-September: Wells 1951	Wells 1950	Percent Diff.	Footage 1951	Footage 1950	Rigs in Operation (Drilling, Rigging-Up and Shut Down): Sept. 30, 1951	Aug. 31, 1951	Sept. 30, 1950
Alabama	1			7				8		8	3	1	44,621	46	31	+ 48.4	220,744	123,745	4	5	7
Arizona				1				1		1			2,517	3	4	— 25.0	6,337	15,597		2	5
Arkansas	20		1	19				40		40	47	31	143,876	312	295	+ 5.8	1,075,462	987,394	37	35	26
California	154		4	50				208	8	216	187	159	849,541	1,804	1,407	+ 28.2	6,976,304	5,697,558	277	236	208
Colorado	13		2	22				37	1	38	25	13	188,940	192	55	+ 249.1	932,627	208,738	42	40	21
Florida											1	1		3	11	— 72.7	14,614	69,518	1		1
Georgia															3	— 100.0		13,270			
Idaho														1	3	— 66.7	12,844	8,540	1	1	2
Illinois	89			155				244		244	250	309	645,440	1,767	2,122	— 16.7	4,438,362	4,569,962	217	201	255
Indiana	59		2	118				179	1	180	156	146	340,608	973	1,200	— 18.9	1,778,521	2,064,096	189	187	198
Kansas	184		49	160			4	397		397	390	346	1,374,731	3,114	2,857	+ 9.0	10,641,730	9,185,208	408	422	322
Kentucky	51		19	71			1	142		142	120	149	303,215	966	921	+ 4.9	1,966,874	1,691,818	103	99	106
Louisiana	118	12	12	74				216	3	219	256	218	1,371,854	1,658	1,838	— 9.8	10,504,129	11,077,369	231	229	227
North Louisiana	69	5	9	43				126	1	127	172	113	479,092	921	977	— 5.7	3,527,285	3,416,090	78	77	67
South Louisiana	49	7	3	31				90	2	92	84	105	892,762	737	861	— 14.4	6,976,844	7,661,279	153	152	160
Maryland				3				3		3	4	1	13,067	26	2	+ 1200.0	104,191	6,481	29	28	2
Michigan	25			37				62		62	69	75	148,494	532	610	— 12.8	1,322,994	1,429,798	110	111	142
Mississippi	10		1	21				32		32	38	23	229,068	273	258	+ 5.8	1,780,353	1,857,059	37	37	28
Missouri				1				1		1			2,059	4	23	— 82.6	2,717	14,585	5	6	8
Montana	10		5	4				19	2	21	37	24	38,984	200	197	+ 1.5	450,694	499,063	58	46	41
Nebraska	6			16				22		22	15	16	103,704	119	74	+ 60.8	555,274	312,451	22	18	11
Nevada														2			15,431		1	1	2
New Mexico	29	1	14	14				58	2	60	57	50	325,165	510	461	+ 10.6	2,483,170	2,047,887	168	149	87
New York	24				18			42		42	53	88	60,850	401	600	— 33.2	572,373	882,840	58	60	112
North Carolina																					
North Dakota				1				1		1	2		5,383	7			39,182		7	6	1
Ohio	24		21	35				80	1	81	82	99	182,697	677	735	— 7.9	1,372,710	1,523,303	155	149	156
Oklahoma	230	1	24	177	10	2	1	445	15	460	548	522	1,608,910	4,167	3,988	+ 4.5	14,913,209	14,052,431	615	610	671
Oregon																					1
Pennsylvania	61		12	2	61	4		140	3	143	150	143	236,699	1,139	1,217	— 6.4	1,954,452	2,208,133	262	252	253
South Dakota												2			5	— 100.0		16,922	3	1	1
Tennessee														6	3	+ 100.0	7,465	3,993	8	9	8
Texas	845	13	113	522	9		2	1,504	30	1,534	1,698	1,411	6,685,707	13,569	12,519	+ 8.4	58,891,818	53,155,574	1,829	1,701	1,369
Dist. 1 S. Central	23		2	16				41	3	44	81	42	91,214	467	366	+ 27.6	1,292,891	1,025,593	35	29	30
Dist. 2 Middle Gulf	23	8	11	31				73		73	73	48	441,040	582	499	+ 16.6	3,413,918	2,892,621	58	66	55
Dist. 3 Upper Gulf	72	1	11	39				103		123	128	144	798,258	1,163	1,196	— 2.8	7,221,708	7,046,122	144	136	126
Dist. 4 L. Gulf-S.W.	62	1	13	57	2		1	136	1	137	150	131	664,803	1,302	1,242	+ 4.8	6,395,179	5,980,079	122	126	121
Dist. 5 E. Central	29			17				46	1	47	42	12	225,690	368	148	+ 148.6	1,460,921	643,356	29	26	18
Dist. 6 Northeast	27	3	4	11				45		45	53	42	265,348	534	467	+ 14.3	2,723,249	2,270,770	41	40	33
Dist. 7-B N. Cent.	118		6	165				289	2	291	278	201	824,486	2,154	1,503	+ 43.3	6,172,773	4,191,714	206	194	104
Dist. 7-C W. Cent.	85		1	48				134		134	165	80	651,563	1,098	690	+ 59.1	5,025,735	2,775,865	220	177	86
Dist. 8 West	242			38				280	22	302	395	343	1,610,813	3,022	3,172	— 4.7	16,359,751	17,024,434	567	507	509
Dist. 9 North	130			80	7		1	218	1	219	199	285	710,302	2,175	2,480	— 12.3	6,576,477	6,935,558	281	274	196
Dist. 10 Panhandle	34		65	20				119		119	134	83	402,190	704	756	— 6.9	2,249,216	2,369,462	126	126	91
Utah				3				3		3	7	5	16,092	25	19	+ 31.6	117,444	67,571	31	27	8
Virginia																			1	1	1
Washington															2	— 100.0		16,032	1	1	
West Virginia	3		37	10				50	1	51	43	64	141,349	445	492	— 9.6	1,285,924	1,253,217	215	205	260
Wyoming	43			31				74	3	77	71	58	415,211	569	441	+ 29.0	2,833,141	2,174,145	112	113	93
Total U. S.	1,999	27	316	1,554	98	6	8	4,008	70	4,078	4,309	3,954	15,478,782	33,510	32,393	+ 3.4	127,271,090	117,234,298	5,237	4,988	4,633

Industry Must Guard Against Government Encroachment

An Interview with

Frank M. Porter
President, American Petroleum Institute

EDITOR'S NOTE: *Frank M. Porter has been in the oil business more than three decades. His first employment in the industry goes back to 1916, when he became connected with the Dundee Petroleum Company at Ardmore, Okla. In 1918 he became associated with Wirt Franklin, independent operator in southern Oklahoma, and nine years later became vice president in charge of production for the Wirt Franklin Petroleum Corporation, organized in 1927. In 1939, with the late Leslie Fain of Oklahoma City, he formed the Fain-Porter Drilling Company. After the death of Fain in February, 1944, Porter became sole owner. On November 30, 1943, Porter was elected president of the Kansas-Oklahoma Division, Mid-Continent Oil and Gas Association, and served three terms in office. He became acting president of the general Mid-Continent Oil and Gas Association upon the death of J. C. Hunter two years later. He was elected president in 1946. In addition to his Mid-Continent activities, Porter has been a member of The American Petroleum Institute board of directors and has long been identified with other trade associations, including the Independent Petroleum Association of America and the American Association of Oilwell Drilling Contractors. He was elected to his present API office in 1950.*

Q. *The Federal Power Commission ruled in the recent Phillips case that it had no jurisdiction over production and gathering of natural gas. Do you feel oil and gas producers are still in danger of government encroachment, or did the ruling erase all possible danger of government control?*

A. As long as any possibility of government control over the oil and gas industry exists, the producers are in danger. FPC's ruling did not erase all possible danger of federal encroachment. I think the industry must be continually watchful of any attempt on the part of any group to gain, for the government, control over either the oil or natural gas industry.

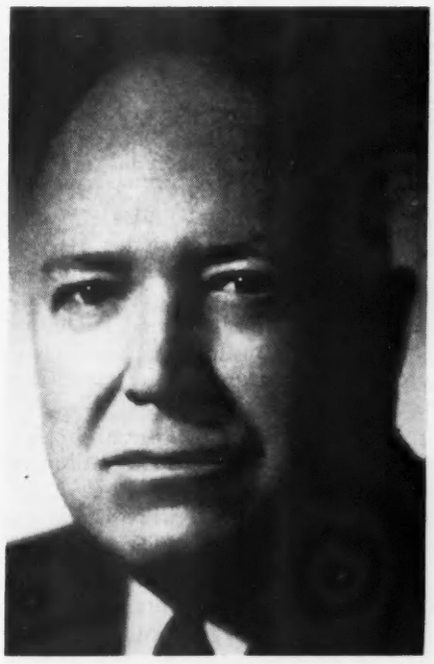
Q. *Is it desirable for Congress to pass legislation specifically limiting the power of the FPC with respect to the production and gathering of natural gas?*

A. Yes. The Kerr bill vetoed by President Truman was an example of such legislation. I hope that some day legislation entirely freeing the petroleum industry from the danger of government control will be passed.

Q. *Would natural gas consumers benefit or be injured by FPC regulations? If so, in what manner?*

A. Certainly, natural gas consumers would be injured. Together with any market restriction goes increased prices. It is elemental economics that consumers profit most under a free market.

Q. *How successful has the oil industry been in overcoming the loss of Iranian oil production?*



FRANK M. PORTER

A. Without referring to figures, I think the oil industry has done a wonderful job of making up for that loss.

Q. *How has it been done?*

A. By continued drilling. In oil countries throughout the world, emphasis has been placed on increased production, particularly in the Middle East, where wells can be drilled at will in proven territory.

Q. *Has industry succeeded in overcoming the loss of Abadan's refinery output?*

A. To a degree. Greater strides may be expected from England, France, Italy and Germany, as refinery improvements reflect increases in output. Naturally, the U. S., which has been helping to make up the difference, in refinery loss due to Abadan's shutdown, cannot forever take up the slack.

Q. *Can you foresee any need for synthetic fuel production?*

A. Not in the immediate future. If the petroleum industry is allowed to operate as it has operated heretofore, it will produce the oil that is required, whether from natural petroleum or by

• CONTINUED ON PAGE 58

"I Have Run a Good Race . . ."

Making Dreams Come Alive Was Genius of Edgar Davis

FANTASTIC achievements of a caliber reached by few men were commonplace in the 78-year-long career of Edgar Byram Davis of Luling, Texas, who died in a Galveston hospital October 14.

Discoverer of the Luling oil field, which opened the lower reaches of the Balcones Fault production, Davis was riding a camel in the Sahara desert when he received what he described as a divine revelation that drew him to Luling and to subsequent oil wealth. Returning, he helped organize United North and South Development Company, which immediately drilled three dry holes.

Three more wells were drilled simultaneously. During the while, funds vanished and the outlook grew dim. Davis' unpaid crew stayed on out of loyalty to him and in deference to a mutual faith. Providence took a hand, however, and Davis' secretary discovered some forgotten securities purchased for him by his brother who had died while Edgar B. was overseas. This kept the company operating for a time.

Office furniture was sold, the properties including leases and rig were put up as security on a $25,000 loan.

Ultimately, however, Davis conceded defeat, and dictated a letter to Magnolia Petroleum Company at Dallas, his creditors: "Like Saint Paul, I have run a good race, but I have lost." He suggested the creditors assume control of the collateral.

While his secretary transcribed the letter one August day in 1922, Davis went out for a last look at his faithful crew and the well they were drilling. At that moment he was close to being a defeated man—his hopes vanishing, his funds depleted, his future dark. As he drew in sight of the rig, he stood stock still, a prayer of thankfulness on his lips. Oil was spurting over the crown block!

Soon after the discovery well, Rios 1, came in, Davis, then a big man with a fringe of red hair on a bald pate, walked into the office of the publisher of WORLD OIL (then *the Oil Weekly*) and announced he was thinking of selling by auction some Luling leases to obtain some money. He wanted advice.

The publisher had received scout reports that the well was making 135 barrels a day, but cautiously asked Davis, "How much is the well making?"

"It's making 120 barrels a day," Davis answered.

The publisher rose from his desk, walked around to confront the intrepid discoverer, and pushed out his hand.

"I'd like to shake your hand again," he said. Davis was the first wildcatter he knew to underestimate his own discovery. From that meeting, a lasting friendship was born. The advice was not to auction but make a private deal.

Later, an incident occurred in which Rice Institute at Houston came within a few hours of being endowed by Davis with a school of petroleum technology. Davis and the publisher met accidentally one day in New York, and, during the ensuing conversation, Davis remarked he had just sold his Luling properties to Magnolia for several million dollars and that he would like to do something for the state in which he made so much money.

A school of petroleum technology at Rice Institute, Houston, then the center of much of the state's oil industry, was suggested, as the state at that time had no such courses to offer interested young men.

Davis asked the publisher if he would inquire whether Rice Institute board of directors would consider an endowment for such a school. As soon as possible, the publisher did, and returned to Davis with the board's affirmative decision to find that only a matter of hours before his arrival, Davis had agreed to set up the $1 million Luling Foundation to purchase and maintain a model demonstration farm to aid rural youth and promote better agricultural practices throughout the state.

Details on Rice Institute and other subjects were not published until after Davis' death, a request the wildcatter made of the publisher when the latter was chronicling much of Davis' history.

While in the Orient on one of his 11 round-the-world jaunts, Davis was intrigued by two concepts: the theory of reincarnation of the eastern religion and the cultivation of rubber trees at Sumatra and other East Indian islands. The first remained with him throughout his life; the second reached fulfillment when the U. S. Plantation Company was organized and he was given $10 million with which to develop the industry. Obtaining Brazilian seeds by having them taken up the Amazon river to skirt the inherent national disinclination for permitting their exportation, Davis finally succeeded in having them sent to the East Indies, and later planted the seedlings in Sumatra. Davis became a vice president and director of the U. S. Rubber Company, and was offered the presidency of the organization, but declined. He later sold his rubber holdings for about $2 million.

It was that money which helped finance his later oil field activities at Luling. What Davis did with his wealth, how he financed a play in New York which portrayed a principle in which he was interested, how he took care of his employes, how ownership of his Cape Cod summer home became the basis of a suit by the State of Massachusetts to take from him the proceeds of his success in Texas are all stories which came after he sold his Luling properties to Magnolia for $12 million. But a series of oil fields along the Balcones Fault in Central Texas are monuments to his faith—and his courage.

Guard Against Government Controls, Porter Warns

■ CONTINUED FROM PAGE 57

synthetic methods. When the time comes for the synthetic production of liquid fuels, the oil business is the most logical one to do it. Right now, the industry needs steel, and it should not lose steel supplies to a synthetic program of doubtful soundness.

Q. *Under the high producing rates in recent months, how near is the nation to the maximum producing rate?*

A. The maximum producing rate depends upon reserves. Right now there is a lot of oil in the West Texas area, the Rocky Mountains section and perhaps the Williston Basin. Much pipe line construction is under way to bring production from those sections into use. I think the oil men are doing a grand job, and I'm proud of them.

Q. *In view of the war possibility, should steps be taken to increase the nation's producing ability to give an emergency backlog? If so, what steps?*

A. Certainly those steps should be taken. But they probably should be directed toward locating more oil reservoirs, and that means drilling. I don't think aboveground storage is the solution.

Oil From Coal NOT NEEDED

By DON KLIEWER

WORLD OIL Staff

THE government, swimming in debt and waterlogged by a continuing flood of money requests from its burgeoning domestic bureaus and foreign policy sinecures, stands ready to pitch almost $3 per capita into an industrial project soundly denounced by private technical experts as unnecessary.

And unless Interior Secretary Oscar L. Chapman is blocked in his effort to prescribe a cure for a petroleum shortage which does not exist, $400 million of heretofore easy to legislate, never easy to earn tax money will be spent to erect a coal-to fuel project which would eat heavily into already-short steel and manpower supplies. Without any actual experience in the petroleum or any other industry but seemingly with administration blessing, the former Denver probation officer apparently is standing adamant in the face of proof offered by the oil industry, oil state senators, Congress, and even reports from his own bailiwick that point to the doubtful current economic value of such an enormous, expensive undertaking.

OIL INDUSTRY'S record for supplying the nation's petroleum needs has remained unblemished throughout the years. And all available facts point to no change in this happy balance, despite bureaucratic cries of oil shortages. However, Interior Secretary Oscar Chapman wants to hand out $400 million in tax money for a synthetic coal-to-fuel project as a solution to a problem which does not exist. Into this premature coal-squeezing venture would go upwards of 175,000-200,000 tons of precious steel and a large slice of the nation's available manpower, both badly needed by the oil industry which can, if permitted, fulfill the country's oil requirements for years with natural petroleum. When crude becomes scarce and the price spirals in the yet far-distant future, oil men will stand ready, as always, to meet oil demand without government assistance by turning to the field of synthetics.

More Steel, More Oil

A recent Bureau of Mines forecast placed domestic demand for all oils this year at an average of 7,101,000 barrels a day. The National Petroleum Council reported that between 7,409,000 and 7,566,000 barrels a day is available. During September, the U. S. produced approximately 6,885,000 barrels of crude and natural gasoline daily. That the industry is not producing quite all of the current domestic demand does not mean it cannot. NPC estimates that before 1956, production capacity will lie between 7,789,000 and 8,838,000 barrels daily, depending upon how much steel is allocated to the industry by the government.

A single synthetic fuel plant, such as Chapman is proposing, could produce 30,000 barrels of liquids daily for an initial cost of $400 million, the price of about 40,000 homes which could adequately house 160,000 persons. Or the price of drilling 5000 wells, of which at least 3250 likely would produce oil, providing under an average allowable of only, say, 50 barrels a day, 160,000 barrels of crude—about five times as much as Chapman's coal-squeezing synthetic fuel plant!

The difference between the construction of this synthetic plant and the drilling of 5000 wells is exactly $400 million in tax money. Whereas the taxpayers will foot the government's program, the oil industry operates on its own money. That is a difference of no small concern to the nation at large. With a total tax hike of $15¾ billion since the Korean "police action" began, the federal tax level has just about shot up to the point of diminishing returns. To pay as we go for the "police action," as originally intended, is made impossible by the multiplied administration requests for money with which to underwrite a growing assortment of projects somewhat illogically tied to present emergency needs.

That bureaucratic reasoning is not new. The current emergency is used as was that in World War II as an excuse for putting the government into the petroleum industry through the door of synthetics.

No synthetics were produced during World War II because no justification for them was found. Now, less justification exists because proved reserves of petroleum subsequently have been greatly increased, not only in the U. S. but also in Canada, Venezuela, the Far East, and the Middle East. As long as presently proved and indicated petroleum reserves are available to the world, the need for synthetics is economically circumscribed.

Industry Alert

The oil industry is alert to the possibility of synthetically producing fuels on a commercial scale. The industry has in operation at Brownsville, Texas, a plant which makes liquid fuels from natural gas. Similar plants reached the blueprint stage but were shelved because, as oil became more plentiful, it was found that the construction and operation of proposed synthetic plants was not economically feasible.

In agreement with the oil industry is the Battelle Memorial Institute of Industrial and Scientific Research,

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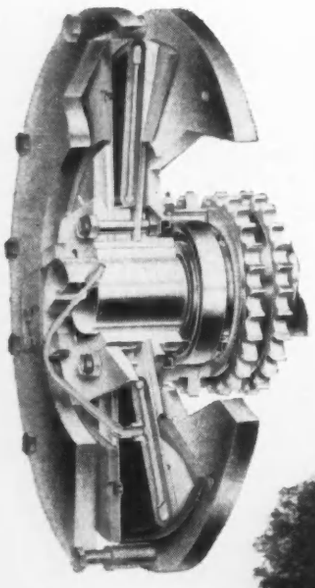

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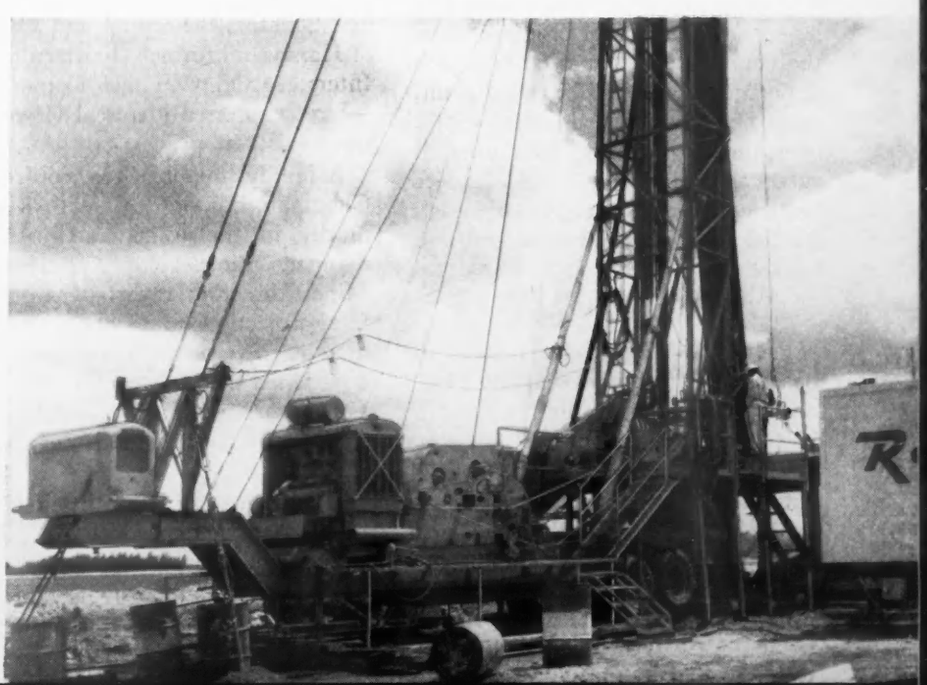

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TWENTY-FIVE YEARS CARDWELL SERVING THE OIL INDUSTRY

Columbus, Ohio, which has reported that at present prices, there is little chance of developing a manufactured gas from coal which can compete directly with natural gas. For the situation to reverse itself, delivered wholesale prices of natural gas would have to double, at least, according to Dr. John F. Foster, Battelle fuels expert, and Dr. Richard J. Lund, authority on enginering economics.

Therefore, the government's insistence on the construction of synthetic fuel plants in the face of these data and expert findings has been likened unto the Tennessee Valley Authority as a step toward the English brand of socialism.

Initially "sold" to the public as a soil conservation and flood control measure, TVA actually developed into out-and-out government production of electric power on a vast scale. The process may eventually involve the most extensive bureaucracy ever seen in industry. The ultimate aim is to divide the whole nation into authorities under which the government could produce electrical power and strongly control the national economy. The nation is now at the point where certain projects have been proposed to put the government strictly into the production of electricity by means of steam, generated from coal, with no flood control, soil conservation or hydroelectric power involved.

Why the government should want to splurge swiftly-vanishing tax monies on a synthetic fuel program which the country does not need is beyond understanding. If it has as its ultimate objective governmental control over the oil business, then upon its success the industry would, indeed, become an abject object of waste, inefficiency and ridicule.

Wilson's Views

Robert E. Wilson, chairman of the board, Standard Oil Company (Indiana) paints a believable but blushing picture of such a venture:

"In this country about 8000 wildcat wells were drilled last year—by "wildcats" I mean wells drilled generally a mile or more from production, where we are hoping to open up a new area or find a new field. If we hadn't risked drilling them we wouldn't have found the reserves, and we wouldn't have kept up with demand. Of those wildcats 85 percent were dry holes. The average cost of those wildcats was around $83,000 each. Even the 15 percent which found some oil included many which will never return their cost.

"Can you imagine the government engaging intelligently and efficiently in a wildcatting operation? Can you imagine the Secretary of the Interior explaining to a Senate committee why they drilled in the 85 percent of places that proved dry? Or, what is more likely, trying to explain why all the Democratic county chairmen had their ranches drilled on and the Republicans didn't?

"The one thing we must have in this field is a freedom of enterprise and a reasonable hope of profit. We don't ask for a guarantee. We're not looking for security as long as we have opportunity, but we must have that freedom of opportunity."

Fighting for that opportunity, the oil industry has protested Chapman's program on the grounds that a premature industry may gobble up from 175,000 to 200,000 tons of steel badly needed by the petroleum industry. That is more than twice the amount allocated to the refining branch of the oil industry during the third quarter of this year and about equal to the 188,332 allocated for the final quarter. Thus, irrevocable harm could come as a result of governmental eagerness for synthetics, on which three senators from two oil states—Senator Kerr of Oklahoma and Senators Schoeppel and Carlson of Kansas, all former chairmen of the Interstate Oil Compact Commission—have expressed identical views: No need exists at present.

A family squabble, too, confronted Chapman, but he dealt with it summarily in the usual administration manner. James Boyd, Bureau of Mines director, reportedly made a fatal objection to Chapman's hasty action on the synthetic issue and questioned the secretary's cost figures. For this, Boyd was apparently fired from his post as minerals defense administrator.

The Bureau of Mines itself claims, after extensive experiments at various pilot plants, that synthetic fuels can be made economically competitive. This claim is disputed by the oil industry, where the consensus is that the government has failed to figure all the cost factors involved and that under present conditions no synthetics can compete with oil. Men in the industry have shown time and again that they're not asleep at the switch and that they will be ready with synthetic production when the need arises, i.e., when petroleum becomes scarce and the price rises to an extreme.

Chapman apparently has disdained familiarizing himself with the facts of life about oil, those offered by the petroleum industry, independent experts and his own department technicians. Dr. H. H. Storch, director of Bureau of Mines experiment station at Bruceton, Penn., advised against the one private group known to be interested in building a coal hydrogenation plant, a group represented by Ferdinand Eberstadt of New York. This advice was contained in a memorandum dated July 3, 25 days before Chapman's request for the required multi-million dollar borrowing power was forwarded to Defense Production Administration, an act which is believed to have been taken without the advice or even the knowledge of the Petroleum Administration for Defense.

Poor Risk

Storch's memorandum reportedly called the 30,000-barrel-per-day synthetic plant a poor risk for private capital. Explaining, therefore, that the subsequent plans of the project's sponsors to request guarantees from the government for the factory price was not surprising, Storch is credited with reasoning that if the sponsors refused to take any risks, it would appear undesirable for the government to do so.

Storch's opinion is that of a sound businessman. If the need did exist for synthetics, the oil business would be the first to admit it and the first to bear down on production of synthetics—without any government guarantees against loss of investment. But oil is plentiful. While the bureaucrats have been crying scarcity, oil men have been going out and finding it at their own expense.

It is that freedom to explore, build, borrow—and even the freedom to go broke—that is necessary if the oil business is to progress. If the government will produce government, the oil industry will produce oil.

Given the materials they require, oil men will fulfill the nation's needs. What they can do if their supply of steel and manpower is arbitrarily channeled into a government whim is a question.

U. S. Net Imports Shrink As Exports Rise

WITHDRAWAL of Iranian oil from world markets has created a steady, increasing demand for U. S. Petroleum exports since the first of the year. And while imports into the country continue at a record rate, the sudden reversal in the downward trend of exports has brought a sharp improvement in the over all foreign petroleum trade of the nation—a net importer since the start of 1948.

During the first nine months of this year total imports averaged 852,200 barrels a day, slightly above the 1950 peak annual rate, but export shipments jumped from a daily average of 268,600 barrels in January to approximately 565,000 barrels in September, equal to an average of almost 402,000 barrels a day for the period. This resulted in a substantial reduction in the total import balance (net imports) from a daily average of 713,600 barrels in January to 180,000 barrels in September. (See table). While there are indications the volume of foreign purchases in the U. S. during the remainder of the year will be sizably lower, its anticipated petroleum shipments into the country also will decline slightly, with the result the import balance for all of 1951 probably will be less than the record 550,700 barrels a day of 1950.

While fast mounting production abroad, particularly in the Middle East, would indicate the long-range outlook is for a continued high rate of imports, any forecasts of U. S. exports of petroleum beyond the end of 1951 is clouded in the Iranian oil dispute. A survey of industry officials however, reveals increases in crude output and refinery capacities throughout the world can be expected to result in a decreasing need in Europe, Africa, and Canada for U. S. petroleum, regardless of whether Iran's oil ever re-enters world commerce.

The rapid buildup of production in Sandi Arabia and Kuwait already has approximately offset the loss of Iranian oil and has caused Petroleum Administration for Defense to lower its estimates of U. S. petroleum requirements needed to help fill world demand during the final months of the year. PAD in mid-August anticipated the domestic industry would be called on to supply 270,000 barrels daily of refined products (in addition to normal shipments) and 190,000 barrels a day of diverted crude imports, a total of 460,000 barrels per day, to fill the gap created by the shutdown in Iran. PAD now places the requirement on the U. S. industry at 190,000 barrels a day of products and 90,000 barrels daily of diverted crude, or a total of 280,000 barrels daily, for the remainder of the year.

In attributing the lower U. S. world requirements to increased Middle Eastern crude output, higher runs to stills in refineries outside the U. S. and a reduction of 75,000 barrels daily in foreign petroleum products demand, Petroleum Administrator Bruce K. Brown warned that if Iranian supplies should continue disrupted during the first quarter of 1952 "we expect petroleum shortages outside the U. S. to exceed those of the September-December 1951 period." Steadily increasing production and additions to refinery throughout capacities abroad, however indicate that the shortages outside the U. S. next year will be filled from sources outside the U. S., barring disturbances in other Middle East nations.

While refined product imports, consisting mostly of residual fuel oil, have declined from an average of 482,500 barrels daily in January to 221,500 barrels a day in September, the high level of crude imports continues to be a cause for concern by a large segement of the domestic industry. Crude oil imports during the first nine months of the year, despite a higher tariff on most of the volume since early June and the extra demand abroad caused by the Iranian shutdown, averaged 513,600 barrels a day, compared with an average of 484,100 barrels daily for all 1950. Opponents to imported petroleum agree no domestic production currently is being supplanted by foreign oil. Testimony was presented by the Independent Petroleum Association of America early in October to the U. S. Tariff Commission in the matter of supplementary trade agreements with Venezuela. It was stated that a possible resumption of export shipments of Iranian oil to nations

▪ CONTINUED ON PAGE 66

Postwar Trend of Petroleum Imports and Exports

(Daily Average in Barrels)

YEAR	IMPORTS			EXPORTS			Net Imports
	Crude Oil	Products	Total	Crude Oil	Products	Total	
1946	235,800	141,400	377,200	116,300	303,200	419,500	42,300*
1947	267,200	169,500	436,700	127,000	323,600	450,600	13,900*
1948	352,300	161,100	514,000	108,200	259,100	367,400	146,600
1949	424,200	217,000	641,200	90,200	263,300	327,100	314,100
1950	484,100	362,500	846,600	96,000	199,900	295,900	550,700
1951:							
January	499,100	482,500	981,600	94,000	174,600	268,600	713,000
February	467,700	469,400	937,100	88,000	189,000	277,000	660,100
March	482,900	377,100	860,000	85,100	235,400	320,500	539,500
April	510,600	365,900	876,500	120,500	264,600	385,100	491,400
May	517,800	358,000	875,800	58,000	359,400	417,400	458,400
June	563,000	312,800	875,800	78,000	343,900	421,900	453,700
July	547,500	241,900	788,400	74,800	435,700	510,500	277,900
August	520,400	218,000	738,400	90,000†	360,000†	450,000†	288,400†
September	523,900	221,500	745,400	100,000†	465,000†	565,000†	180,400†

* Net Exports. † Partially estimated.

Source: U.S. Bureau of Mines. August and September imports from American Petroleum Institute.

Mounting Exports Increase

By ROBERT E. SPANN

WORLD OIL Staff

Bureau of Mines Revised Forecast of Supply and Demand

(Thousands of Barrels Daily Average)

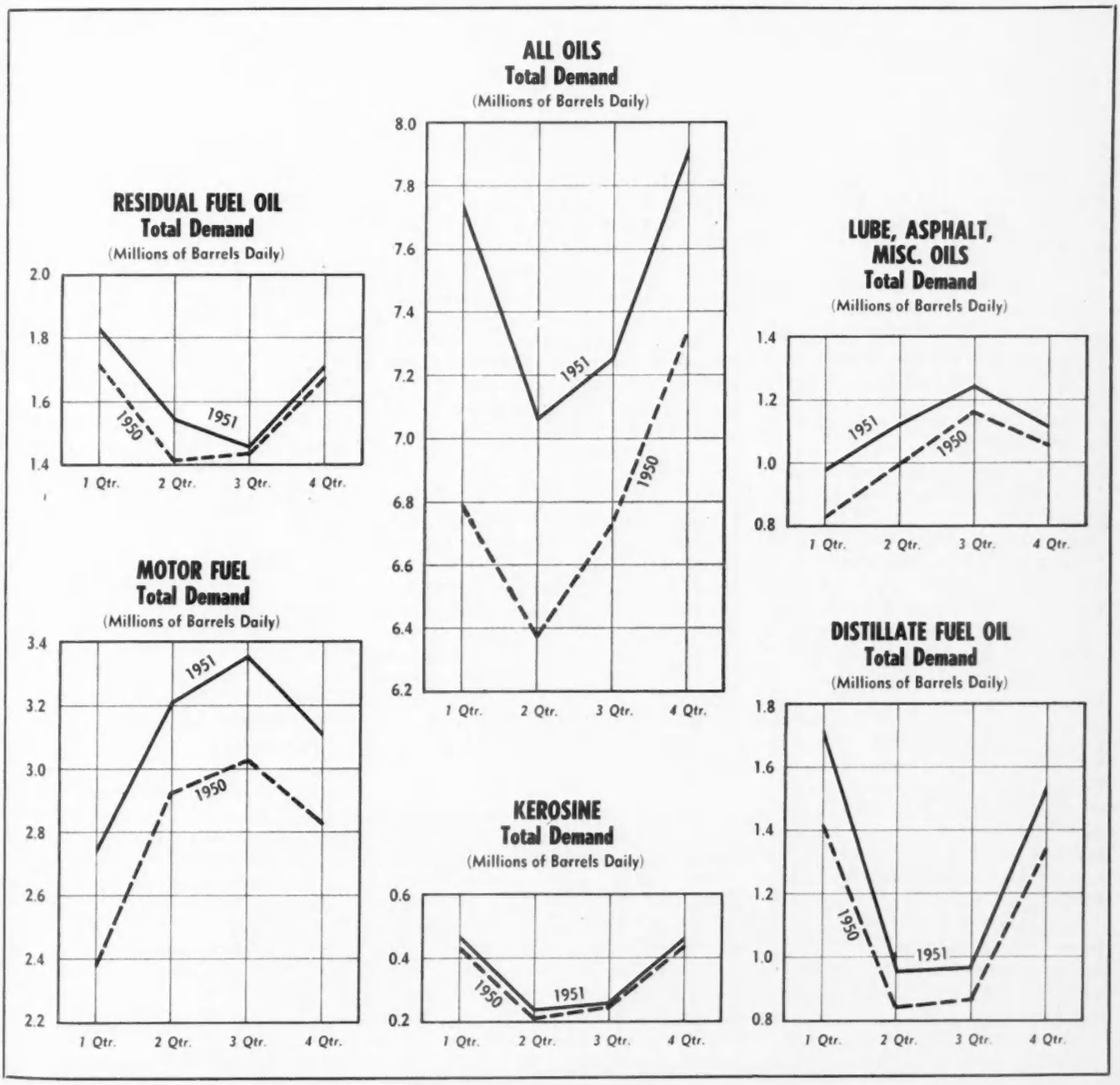
	ACTUAL		REVISED ESTIMATE			Prev. 1951 Estimate	Actual 1950	Percent Diff. '51-'50
	First Quarter	Second Quarter	Third Quarter	Fourth Quarter	Year 1951			
DEMAND								
All Oils—								
Total Demand	7,737	7,063	7,250	7,913	7,490	7,452	6,803	+ 10.1
Domestic	7,448	6,654	6,785	7,522	7,101	7,178	6,499	+ 9.3
Export	289	409	465	391	389	274	304	+ 27.9
Crude Oil	89	86	78	65	79	74	95	— 16.8
Products	200	323	387	326	310	200	209	+ 48.3
Motor Fuel								
Total Demand	2,732	3,210	3,348	3,109	3,101	3,104	2,792	+ 11
Domestic	2,668	3,117	3,230	3,011	3,008	3,041	2,725	+ 10.3
Export	64	93	118	98	93	63	67	+ 38.8
Residual								
Total Demand	1,826	1,543	1,449	1,706	1,630	1,652	1,559	+ 4.5
Domestic	1,788	1,463	1,348	1,630	1,556	1,614	1,515	+ 2.7
Export	38	80	101	76	74	38	44	+ 68.1
Distillate								
Total Demand	1,725	956	965	1,522	1,290	1,274	1,116	+ 15.5
Domestic	1,693	900	888	1,446	1,230	1,241	1,081	+ 13.7
Export	32	56	77	76	60	33	35	+ 71.4
Kerosene								
Total Demand	473	236	249	457	354	364	329	+ 7.6
Domestic	469	220	237	446	343	359	323	+ 6.1
Export	4	16	12	11	11	3	6	+ 83.3
Other Oils								
Total Demand	981	1,118	1,239	1,119	1,115	1,058	1,007	+ 0.7
Domestic	830	954	1,082	989	964	923	855	+ 12.7
Export	151	164	157	130	151	135	152	— 0.6
STOCK CHANGES								
Total, All Oils	—283	+497	+296	—239	+69	+77	—56	.....
*Crude Oil	—163	+158	+ 69	+ 11	+19	+14	—13	.....
Other Oils	—120	+339	+227	—250	+50	+63	—43	.....
NEW SUPPLY								
Total New Supply	7,454	7,560	7,546	7,674	7,559	7,529	6,747	+ 12
Domestic Production	6,528	6,684	6,758	6,832	6,702	6,586	5,900	+ 13.5
Crude Oil	5,965	6,143	6,209	6,239	6,140	6,027	5,402	+ 13.6
Other Oils	563	541	549	593	562	559	498	+ 12.8
Imports	926	876	788	842	857	943	847	+ 1.2
Crude Oil	484	531	529	505	512	537	487	+ 5.1
Products	342	345	259	337	345	406	360	— 4.1
Runs to Stills	6,492	6,398	6,538	6,609	6,510	6,421	5,739	+ 13.4
†Demand for Domestic Crude	6,106	6,004	6,133	6,225	6,118	6,014	5,419	+ 11.0

* Domestic and Foreign. † Domestic production plus or minus withdrawal or addition to stocks of domestic crude.

Oil Demand In U. S.

TOTAL DOMESTIC and export demand for all oils in 1951 now is expected to reach a new peak of 7,490,000 barrels daily. This recently revised forecast of the Bureau of Mines would be 687,000 barrels a day or 10.1 percent more than demand in 1950. The estimate is 38,000 barrels a day higher than that made at mid-year, and indicates more demand for domestic crude production than previously estimated. Forecasts of domestic requirements for some products have been revised downward, but the reductions have been more than offset by increases in estimates of exports.

TOTAL requirements for U. S. petroleum this year will run higher than had been anticipated at mid-year, due to mounting export shipments, though estimates of domestic demand have been lowered slightly, according to the latest revised forecast of the U. S. Bureau of Mines. Over the long run the agency predicts the trend of expansion of oil demand to continue into 1952 with an indicated first quarter demand of 8,140,000 barrels daily, an increase of 5.2 percent over



actual consumption in the like 1951 period.

Combined domestic and export demand for the full year 1951 is now expected to reach a new peak daily average of 7,490,000 barrels, up 687,000 barrels, or 10.1 percent, over the 1950 average and 38,000 barrels a day above the bureau's June prediction. The bureau's newest estimate of domestic demand gives some confirmation to a trend of declining U. S. consumption within the U. S. that has been forecasted by some industry economists. Total requirements for the U. S. for the full year are placed at a daily average of 7,101,000 barrels, a reduction of 77,000 barrels, or about 1 percent, from the government agency's previous forecast. Domestic demand now is expected to average 9.3 percent above 1950, compared with an increase of 10.4 percent estimated earlier.

Anticipated export demand for crude and products has been boosted sharply to 389,000 barrels a day for the full year, up 42 percent over the earlier expectations and 27.9 percent higher than the 1950 daily average of 304,000 barrels. The over-all increase is almost entirely made up of greater need for U. S. refined products in world markets due to the shut down of the Abadan refinery. According to the bureau's calculations, the peak export demand was reached in the third quarter at a daily average of 465,000 barrels of crude and products. Total exports in the current quarter will recede to an average of 391,000 barrels a day, according to the forecast.

The expansion in total demand, together with a decline in total imports because of diversion of crude and products from the U. S. to Europe and Asia, indicates demand for domestic crude production for the year will average 6,118,000 barrels a day. This would represent an increase of 104,000 barrels daily over the earlier forecast of domestic crude requirements and a jump of 699,000 barrels a day over the demand for domestic output during 1950. Demand for domestic crude production in the current three-month period is expected to reach 6,225,000 barrels a day, 225,000 daily above the previous estimate because of material reduction in imports in the October-December period.

Total imports for the year now are forecasted at 857,000 barrels a day, 86,000 barrels daily less than had been expected, and about 10,000 barrels higher than last year's peak annual average. The largest reduction in total imports is being made in the curent quarter, estimated to average 842,000 barrels daily, or 169,000 barrels under the mid-year forecast.

Reduction in imported oils, however, will be more than offset by higher domestic output of crude, natural gasoline and other liquid hydrocarbons. Total domestic production for the final three months of the year is forecasted at an average of 6,832,000 barrels daily. For the full year, domestic production is estimated at an average of 6,702,000 barrels daily, 116,000 a day above the previous estimate and 802,000 barrels daily, or 13.5 percent, over the 1950 average. Increased crude output will account for all but 3,000 barrels daily in the higher forecast of domestic production.

Domestic crude production, which had been expected to run less in the second half than the daily average of 6,054,000 barrels of the first six months, is estimated at 6,224,000 barrels a day for the June-December period, with the peak coming during the final three months at an average of 6,239,000 barrels a day.

Daily average crude runs to stills have been revised upward by the bureau to 6,510,000 barrels for the year, 771,000 barrels or 13.4 percent, over the 1950 average and 89,000 barrels daily over the mid-year forecast for 1951. Refinery runs in the curent quarter are estimated at an average of 6,609,000 barrels per day, compared with actual runs of 6,492,000 barrels a day in the first quarter, 6,398,000 barrels daily in the second, and 6,538,000 barrels a day in the third quarter.

Seasonal demand trends will push total demand for all oils in the final quarter to 7,913,000 barrels daily, 152,000 barrels a day higher than the June forecast for the peak winter demand, boosting the average requirements for the second half of 1951 to an average of 7,581,000 barrels daily. Actual demand in the first six months of 1951 averaged 7,400,000 barrels daily.

With domestic demand in the October-December period placed at 7,522,000 barrels daily, domestic demand for all oils in the final six months is now expected to average 7,153,000 barrels a day. This represents an average increase of 101,000 barrels daily over actual first half demand, a slightly narrower spread than had been previously forecasted by the bureau. Further indication of some shrinkage in domestic requirements can be noted in the revised bureau figures of actual first half demand. The latest calculations place first six months' demand at an average of 7,051,000 barrels daily, or 65,000 barrels daily less than was shown in the June compilation of demand figures. Also, the current revised forecast lists third quarter domestic demand at 6,785,000 barrels a day, or 182,000 barrels daily below the June forecast.

The bureau's June forecast made allowance for additions to inventories of all oils in the second half of 45,000 barrels daily, consisting totally of oils other than crude, while the latest estimate calculates further additions to stocks in the final six months of the year will average 28,000 barrels daily. This is made up of daily average additions of 40,000 barrels of crude and a net decline averaging 12,000 barrels a day of other oils. In the final three months net declines in stocks of all oils are placed at 239,000 barrels a day.

U. S. Net Imports Shrink

■ CONTINUED FROM PAGE 63

formerly dependent on this source of supply could easily result in large volumes of foreign oil available for importation into the U. S.

The commission's hearing was the result of requests initiated by the Venezuelan government requesting restudy of the 1939 trade agreement between Venezuela and the U. S. This agreement set import duties on crude, topped crude and fuel oil at 10½ cents a barrel for imported volumes up to 5 percent of refinery runs to stills in the U. S. during preceding years. (For example, petroleum imports up to 5 percent of 1950 runs could enter the U. S. in 1951 at this tariff rate, with the remainder taxed at 21 cents a barrel.) While Venezuelan imports to the U. S. in the first six months of 1951 increased to an average of 371,000 barrels daily from 358,000 barrels daily in all of 1950, Venezuela contended the higher rate on its shipments to the country above its quota under the 5 percent formula is injurious to its economy. The higher tariff hurts Veneuzuela indirectly in that so far producing companies in Venezuela shipping to the U. S. have absorbed the additional 10½ cents a barrel duty. This would tend to lower each producer's net income for the year assuming the higher rate is not offset by increased volume of shipments or other export sales. Venezuela's concern stems from the fact that under law it receives at least 50 percent of each company's net profit in royalties and taxes.

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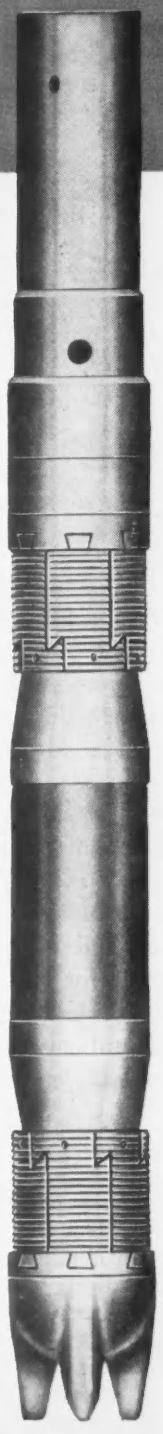

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It's a Pantomime on the Potomac and . . .

Steel Shortage to Continue

A LARGE hand-lettered sign in the office of a top official of the materials division of the Petroleum Administration for Defense in Washington, entitled "Policy" reads:

If industry representatives aren't confused when they come in—get them confused before they leave.—MATERIALS DIVISION.

While cynical, the thought expressed is getting to be the only reply PAD officials can pass to petroleum industry visitors regarding the outlook for controlled materials availability and the reasons behind decisions on allocations to the oil and gas industry by Defense Production Administration. The real confusion, however, is not with oil and gas operators or with the industry men who staff PAD. It is inherent in the entire organization of governmental bureaucracy in the pantomine along the Potomac.

Less for Industry

Out of this muddle PAD officials can make few, if any, definite decisions on materials supplies for the long term, but viewing the future on the basis of past experience, several predictions can be made with some assurance. The most outstanding of these is that there is no chance of oil and gas operators getting increased allocations of steel before the middle of 1952 and possibly not before the end of next year. The coming year will see a sharp expansion in steel requirements of the Defense Department, as indicated by the allocation it received for steel in the first quarter of 1952 of 2,408,700 tons, up 26 percent over the allotment for the current quarter.

CONTINUED SCARCITY of steel for the oil and gas industries is in prospect for 1952. The amount available likely will be no more, and possibly less, than in 1951, although this year's receipts have been only about 75 percent of volumes used in 1950. A relatively good supply of tubular goods apparently will permit drilling at a rate about the same as in 1951 or slightly higher. More line pipe will be made available for building oil pipe lines. But supplies available for natural gas pipe line construction will be extremely short.

This rate of demand, plus the critical shortage of scrap steel needed to produce the essential metal in 1952, dictates a general slowing down in steel use by private industry, including defense-supporting activities such as petroleum. According to best estimates, the total national demand for all types of steel ranges from 50 to 100 percent above the steel industry's productive capacity.

During 1951 the oil and gas industry has been receiving about 75 percent of the steel it used in 1950, and the total volume to be received in 1952 will be no better—possibly less. Based on materials availability, it can be expected the hunt for oil will continue to move at a faster pace then the refining and transportation of crude and products. However, the possibility of drilling 50,000 wells in 1952, as indicated by Petroleum Administrator Oscar Chapman, is out of the question, based on present probable availability of steel.

There are some encouraging signs, however, though none points to increased steel. Total steel tonnage allocated by DPA to the oil and gas industry for domestic and foreign operations in the first quarter of next year was reduced to 1,708,500 tons, or 98,000 tons less than was granted for the current quarter and 473,000 tons below PAD's requests. But chances of operators getting actual delivery of nearly all of the allocation appear much better than has been the experience in the latter part of 1951. The first quarter allocation represents 77 percent of the amount requested by PAD, or one percentage point below the ratio of allocation to requested volume for the current three-month period. PAD officials privately estimate over-all actual deliveries of steel in the early months of next year will average at least 95 percent of allocation. The ratio during the final six months of this year has been no better than 85 percent for oil country tubular goods and line pipe.

Deliveries Better

The improvement in actual deliveries is anticipated, barring steel industry strikes or other disruption of schedules, on the following points:

- The disruption that resulted from the shift to a full Controlled Materials Plan in the third and fourth quarters will not hinder production and delivery in the future.
- The amount of slippage in deliv-

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ery of allocated materials from the fourth quarter into the first three months of next year will be much less than slipped from the third quarter into the final three months of 1951. Some slippage in orders, particularly line pipe, can be expected to continue, possibly well into 1952. Total revaluation of orders not filled in the third quarter amounted to an estimated 35 to 40 percent of total allocation. This high rate will be the cause of some of the slippage into the first quarter of 1952.

● The petroleum industry will find some additional mill capacity for accepting rated orders through a National Production Authority regulation of mid-October, permitting the purchase of conversion steel within CMP. This means steel users can place authorized CMP orders with steel finishing mills where available capacity exists, and then can make necessary arrangements for outside purchase and delivery of the required steel tonnage to complete their order. This regulation, in effect, will allow possible full use of all steel-making capacity.

● Under a revised NPA regulation (Direction 1 to NPA order M-46) effective October 15, operators may now accept delivery of oil country tubular goods (though not line pipe) for which they have priorities assistance whenever the materials can be shipped without having to make adjustment in their outstanding delivery orders. Previously, tubing, casing and drill pipe shipped later than seven days after the end of the quarter for which they were scheduled had to be charged against the next quarter's allotment. This necessitated a revalidation of outstanding claims.

There is still, however, an outstanding adverse factor in CMP regulations and directives that clouds the entire outlook for steel availability. This permits steel mills to accept rated orders for steel based on former customer relationships during the last 15 days prior to the normal 45-day "lead" time required to set rolling mill schedules. For example, the "lead" time for setting next January's schedules starts November 15, so between November 1 and 15 mills may give preference to former customers in acceptance of orders as long as available capacity exists.

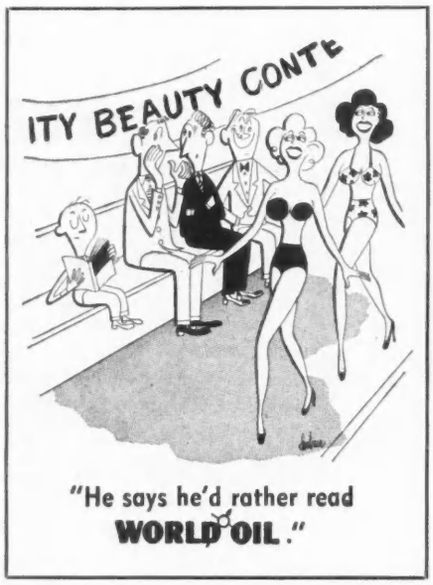
More Tubular Goods

Oil country tubular goods availability likely will continue to be the one bright spot in over-all steel supplies for the petroleum industry. PAD estimates operators in the current quarter are receiving close to 100 percent of total allocation of tubing, casing and drill pipe. Even though total allocation of oil country tubular goods has been trimmed some from PAD desires, well completions are running at an annual rate in excess of 44,000. This indicates the 1951 drilling program will set new records in both total number of wells and footage. Despite public statements of a higher goal for 1952, the actual present program of PAD on oil country tubular goods for next year is planned for the completion of 43,900 new wells, or 500 more than were originally programmed for this year.

The comparatively higher percentage of oil country tubular goods made available to the petroleum industry results from PAD's desire for increased exploratory drilling to uncover new domestic petroleum reserves that could be available for any all-out emergency in the near future. The situation also reflects increased shipments of oil country tubular goods this year by steel mills. Total shipments of tubing, casing and drill pipe in the first eight months of 1951 totaled 1,247,066 tons, up 12.3 percent over the corresponding part of 1950. This amounts to an average of 155,800 tons per month. Shipments in recent months have been increased to a rate of 160,000 tons, or 30,000 tons more than the monthly rate of the first of the year.

Line Pipe Scarce

Line pipe, which has been the most critically short item for the oil and gas industry in 1951, will continue to be extremely hard to get in 1952. While the available supply of line pipe in sizes below 16 inch are not too far out of balance with demand, the availability of larger sizes—made from plate, the most needed steel item for defense—has been well below demand, and this will continue all through 1952. The ratio of deliveries of large diameter pipe to allocation is probably not much higher than 50 percent, and total over-all deliveries of all sizes amount to no better than 70 percent of allocation. This indicates total delivery of line pipe for the current quarter will total less than 650,000 tons if the present delivery trend continues through November and December. At this rate, approximately 240,000 tons of unfilled orders, based on fourth quarter allocation, will remain at the end of the year.



More for Oil Lines

The low ratio of line pipe deliveries is attributable to the shortage of plate for making large diameter sizes and the high allocations of line pipe in relation to the steel industry capacity to produce. Total line pipe shipments in the first eight months of 1951 were 1,953,891 tons, or 19.2 percent less than deliveries in the like period of last year. These shipments are equal to a quarterly rate of 732,330 tons, or less than the third quarter line pipe allocation of 893,221 tons and the fourth quarter allotment of 768,000 tons.

During the early part of 1952, PAD plans to give a higher percentage of the total available line pipe to oil lines, in order to rush completion of several highly needed projects. The new oil lines will move crude from such areas as West Texas and the Rocky Mountains, holding a comparatively high volume of production closed in due to lack of pipe line outlets. This will reverse the trend of 1951, which gave preferred treatment to gas line builders, so that essential projects to consuming areas, largely in the East, could be completed before winter. The gas branch was allotted 67 percent, or 517,000 tons, of the total third quarter line pipe allocation, and was granted 54 percent, or 483,296, of the fourth quarter total.

For the refining and natural gasoline branches, PAD officials say steel and other controlled materials will be allocated for all projects that are highly essential to national defense. But the rate of buildup to be permitted by material allocations will not come up to the rate required to add 1 million barrels daily to refining capacity by the end of 1953.

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TABLE I. COMPARATIVE COSTS FOR 50,000 MILES

	AUTOMOBILE @ 6¢ per mi.	RAIL @ 5¢ per mi.	PIPER PACER @ 6.5¢ per mi.
Mileage Cost	$ 3,000 (for 1 or 5)	$2,500 (for 1)	$3,250 (for 1 or 4)
Personnel Value*	6,250 (for 1)	5,000 (for 1)	2,000 (for 1)
Personal Expense**	1,560 (for 1)	1,250 (for 1)	500 (for 1)
Total Travel Costs	$10,810	$8,750	$5,750

*Personnel value is figured conservatively at $5.00 per hour times traveltime. Average speeds are figured at 50 mph for train; 40 mph for auto and 125 mph for Piper Pacer.
**Personal expenses are figured at $10 per day.

Quite often the cost of transportation itself is the least important. Executive time and out-of-town expenses must be figured also. That's why the swift, comfortable Piper Pacer comes out ahead every time.

TABLE II. ANNUAL COST COMPARISON

MILEAGE	AUTOMOBILE	RAIL	PIPER PACER
20,000	$ 4,320	$ 3,500	$3,320
30,000	6,490	5,250	4,920
40,000	8,650	7,000	5,040
50,000	10,810	8,750	5,750
60,000	12,980	10,500	6,480
70,000	15,140	12,250	7,350
80,000	17,300	14,000	8,120
90,000	19,470	15,750	9,000
100,000	21,620	17,500	9,800

Auto is figured at 6¢ per mile, rail at 5¢. Pacer rate includes all fixed costs as well as maintenance and fuel. At 50,000 miles annually, the cost per passenger-mile by Pacer is only 1.6¢ total!

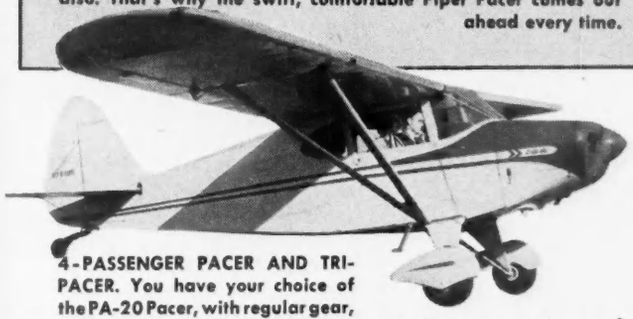

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TABLE III. COMPARATIVE HOURS OF TRAVELTIME

ANNUAL MILEAGE	AUTOMOBILE @ 40 mph (avg.)	RAIL @ 50 mph	PACER @ 125 mph
20,000	500	400	160
30,000	750	600	240
40,000	1,000	800	320
50,000	1,250	1,000	400
60,000	1,500	1,200	480
70,000	1,750	1,400	560
80,000	2,000	1,600	640
90,000	2,250	1,800	720
100,000	2,500	2,000	800

Look at it either way. You spend lots less time travelling by Pacer, or you can make more necessary trips in the same amount of time. By Pacer it's nothing to fly as much as 500 miles to make a call and return the same day.

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New Catalogs AND EQUIPMENT LITERATURE

For copies of the catalogs and new equipment literature listed, use one of the convenient Reader Service Postcards on this page. Just circle the number on the card corresponding to the number of the item in which you are interested.

Water Conditioner

The Accelator water conditioning unit made by Infilco Inc. is discussed in a 28-page bulletin which gives information on historical development, distinguishing characteristics, design, operation and applications.

Circle No. 1 on Postcard

•

Driveshafts

Morse Chain Company has issued a bulletin giving data and specifications on Morflex Radial driveshafts with spline-jointed tubular shafts; Morflex Universal driveshafts with one-piece tubular shafts; and Morflex Universal driveshafts with spline-jointed tubular shafts.

Circle No. 2 on Postcard

•

Water Hammer

Cause, effect and control of water hammer in piping systems are considered in a new eight-page bulletin published by The Williams Gauge Company. After describing water hammer in non-technical terms, the brochure indicates its potential damage to piping, instruments and other parts of water systems, and then discusses methods of controlling it.

Circle No. 3 on Postcard

Clutches and Drives

A 32-page "Cross Country" issue of Twin Disc Clutch Company's Production Road magazine describes almost 60 applications of friction clutches and hydraulic drives in as many types of machinery and equipment.

Circle No. 4 on Postcard

Electric Power

Use of "packaged" electrical systems in industrial expansion is discussed in a new 24-page bulletin available from General Electric Company. The package units eliminate the need for individually-engineered assembly of components.

Circle No. 5 on Postcard

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New Catalogs AND EQUIPMENT LITERATURE

Use one of the free and convenient Reader Service Postcards on this page to request copies of the catalogs in which you are interested.

Wire Rope Handbook

A new 112-page Oil Field Handbook on wire rope published by Mickwire Spencer Steel Division of The Colorado Fuel & Iron Corporation makes available for the first time complete ton-mile tables for calculation of wire rope ton mileage without figuring or computing. The Handbook also contains specific recommendations for both cable tool and rotary drilling requirements.

Circle No. 6 on Postcard

Pressure Switches

A 32-page manual on pressure switches, published by Barksdale Valves, includes a glossary of terms, tabulation of available units based on function and pressure or vacuum range, diagrams for circuit detailing, an electrical rating table and other application data.

Circle No. 7 on Postcard

Oil Field Pump

Chain Belt Company's bulletin on the new Rex "Speed-Primer" pump gives construction details of the 1½-inch pump and discusses field application.

Circle No. 8 on Postcard

•

Welding Alloys

A 10x14-inch chart of Eutectic low temperature welding alloys, issued by Eutectic Welding Alloys Corporation, contains specifications on about 200 metal-joining alloys, including bonding temperatures, tensile strengths, and recommended uses.

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Rotary Compressors

Rotary compressors and vacuum pumps made by Fuller Company are the subject of a new illustrated folder. Principles and operation are explained in the text and illustrated by photographs and cutaway drawings.

Circle No. 10 on Postcard

•

Radio Communication

A new folder describes a stackable single-sideband suppressed-carrier communication system designed by Lenkurt Electric Company for channelizing point-to-point radio communication links.

Circle No. 11 on Postcard

•

Wire Rope Service

Macwhyte Company has issued a Ropeology Bulletin, "Wire Rope—So What?", which presents general information on means to effect savings on wire rope.

Circle No. 12 on Postcard

(More Literature News on Page 80)

WORLD OIL Reader Service POSTCARD — **November, 1951, Issue***

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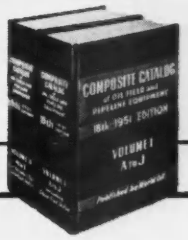
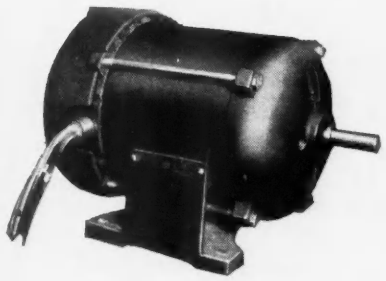
SUPPLEMENTING COMPOSITE CATALOG



KEEP INFORMED by requesting additional information on new equipment and services described on this and following pages. SAVE TIME by using one of the free and convenient Reader Service Postcards on opposite page. Circle number on card corresponding to the number listed at the end of each new equipment item on which you desire additional information.



Fan-Cooled Motor

This item supplements General Electric Company data on pages 1901-1920 of Composite Catalog, 18th Edition.

General Electric Company's Tri-Clad line of single-phase capacitor motors has been extended to include a totally enclosed fan-cooled construction. Starting capacitors and switch are mounted within the frame for maximum protection with minimum space requirements. Available in ratings of 1, 1½, 2, 3 and 5 horsepower, the line was developed for use where extra severe conditions of dirt-grit or moisture are encountered. It is available also in explosion proof and dust-explosion proof construction.

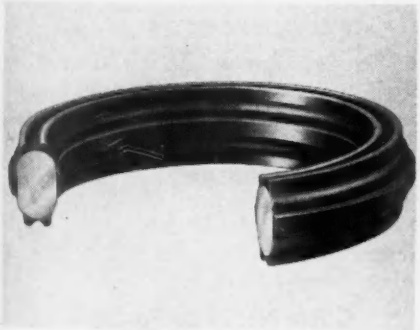
Circle No. 13 on Postcard

•

Ring Joint Gasket

This item supplements Petroleum Mechanical Development Company data on page 4228 of Composite Catalog, 18th Edition.

The new "Flex-Tip" ring joint gasket made by Petroleum Mechanical Development Company is available in all sizes used in well control for pressure of 2000 pounds per square inch and more. The ring embodies two independently acting seals, the first being the standard API metal-to-metal seal, and the other the Flex-Tip mechanism, which uses the interference principle, in a manner similar to that of the O-ring. Inner and outer beads offer substantial protection against mechanical damage to the smooth steel seating surfaces.



Circle No. 14 on Postcard

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Perlite Products

This item supplements Great Lakes Carbon Corporation data on page 1947 of Composite Catalog, 18th Edition.

Grellex perlite products made by Great Lakes Carbon Corporation are completely inorganic, are insoluble in water and most acids and contain no oxidizing elements. They have extremely low electrical conductivity and vapor absorption. Specific heat is approximately 0.20 Btu/lb./°F. Thermal conductivity ("K") factors vary with size gradation, density and mean temperature, ranging from .22 to .35 Btu/sq.ft./hr./°F./in. thick.

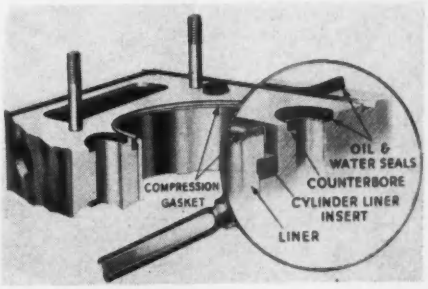
Circle No. 15 on Postcard

•

Diesel Engine

This item supplements Detroit Diesel Engine Division, General Motors Corporation, data on pages 1418-1423 of Composite Catalog, 18th Edition.

The method of oil, water and compression sealing between the engine block and head of Series 71 diesel engines, made by Detroit Diesel Engine Division, does away with the laminated gasket commonly used in internal combustion engines. Compression gaskets, in the form of laminated Terne Plate rings, take the major pressure off the head-to-block stud bolts. Another design change is the special chilled-and-tempered cast iron ring which forms a replaceable seat for the cylinder liner upper flange.



Circle No. 16 on Postcard

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Transformer Welder

This item supplements Air Reduction Magnolia Company data on page 159 of Composite Catalog, 18th Edition.

Airco (Wilson) Model MCM 200 ampere transformer welder, available from Air Reduction Magnolia Company, is designed for general maintenance and production welding. Four variations are made: 220 volt, or a 220/440/550 volt unit, each with or without power factor correction. Open circuit voltages include 80 volts on the low range and 55 volts on the high range.

Circle No. 17 on Postcard

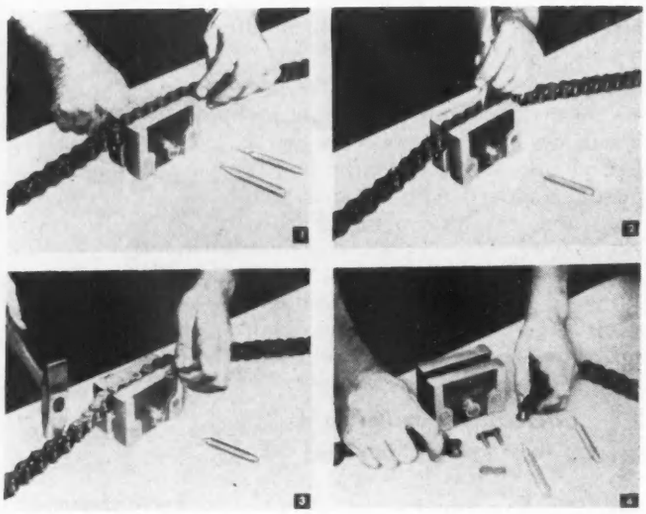
NEW EQUIPMENT

SUPPLEMENTING COMPOSITE CATALOG

To obtain additional information use convenient Reader Service Postcard on page 73. Circle number on card corresponding to number listed at the end of each new equipment item on which more information is wanted.

Chain Vise

This item supplements Chain Belt Company data on pages 3046-3047 of Composite Catalog, 18th Edition.



Disassembling, repairing or connecting roller chain is simplified by use of the new Baldwin-Rex chain vise made by Baldwin-Duckworth division of Chain Belt Company. The vise is made of forged steel, with hardened jaws shaped for adapting to various chain sizes. Approximate adjustments are made before the chain is inserted, permitting rapid clamping. The vise is available in two sizes. Operation of the vise to cut chain is illustrated.

Circle No. 18 on Postcard

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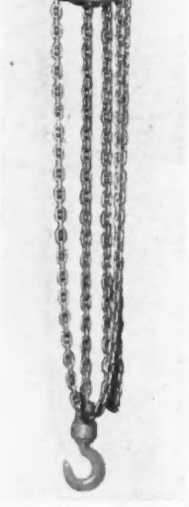
Spur-Gear Hoist



This item supplements Coffing Hoist Company data on page 1269 of Composite Catalog, 18th Edition.

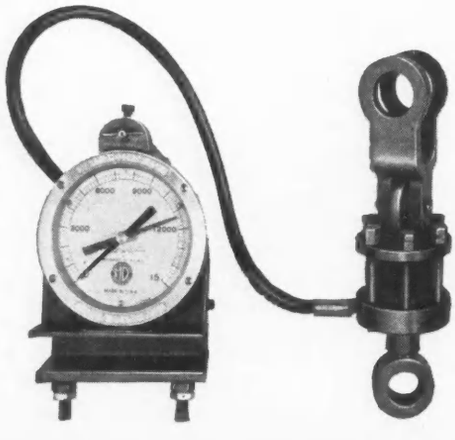
The Challenger, a spur-gear hoist, is now made in ½- and 1-ton capacities, Coffing Hoist Company reports. The entire unit, including standard length of high-strength coil chain for an eight-foot lift, weighs only 39½ pounds. Formed steel plate is used in the housing in place of aluminum alloy, and the back plate is laminated for extra rigidity. This plate and all other load holding parts are of high-strength steel.

Circle No. 19 on Postcard

Tong Torque Instrument

This item supplements Martin-Decker Corporation data on pages 3145-3188 of Composite Catalog, 18th Edition.

Martin-Decker Corporation has developed a Tong Torque Instrument which removes basic causes of drill pipe failure — overtonging, which results in pulled and distorted threads, and running collars too loose, which allows the joints to work, resulting in cracks and washouts. The instrument measures torque when making up and breaking out drill collar joints, and is also useful for torque measurements on pipe and casing joints. A maximum pull can be established and held, regardless of operating variables. It is possible to measure accurately the cable pull when making joints with standard tongs. A clevis fits the tong handle so that the cylinder can be attached or removed without alteration to the lever.



Circle No. 20 on Postcard

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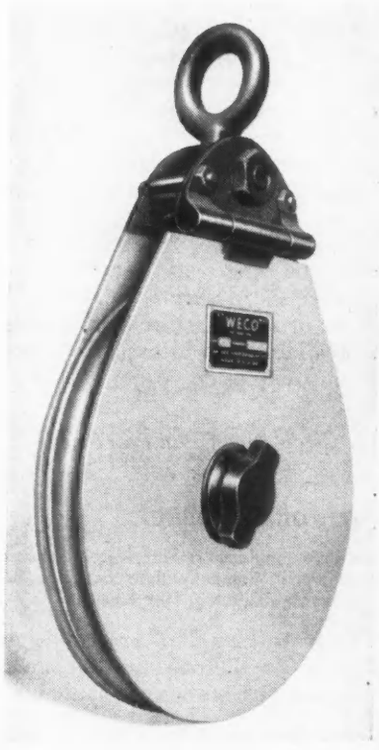
Tong Line Block

This item supplements Well Equipment Manufacturing Corporation data on pages 5037-5064 of Composite Catalog, 18th Edition.

Well Equipment Manufacturing Corporation is manufacturing a tong line block with a 12-inch sheave to provide the extra diameter needed to reduce the bend in the tong line and further facilitate handling the large tongs now being used. Sides of the heavy block are steel plate, and the sheave is malleable iron with web design to reduce weight. It has a forged steel swivel eye.



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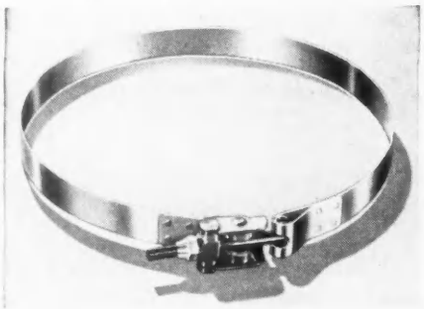
OTHER NEW AND IMPROVED EQUIPMENT

KEEP INFORMED by requesting additional information on new equipment and services described on this and following pages. SAVE TIME by using one of the free and convenient Reader Service Postcards on page 73. Circle the number on card corresponding to the number listed at the end of each new equipment item on which more information is wanted.



Quick Coupling Clamp

Series 21 quick coupling clamp made by Specialty Products Company has a hinged latch for quick assembly or removal. The stainless steel clamp provides an effective seal for all types of hose and duct connections. The clamp is made to order on customer specifications.

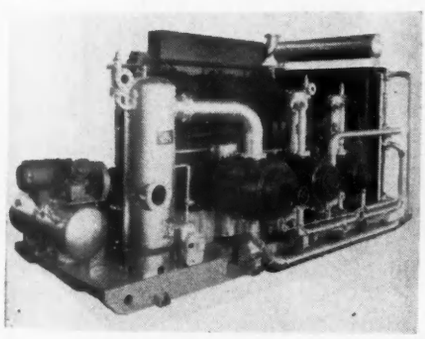
Circle No. 22 on Postcard

•

Compressor Plants

Two new packaged compressor plants with more horsepower per pound than previous models, are being manufactured by The J. B. Beaird Company. They are the 330 horsepower 6 SVG, and the 440 horsepower 8 SVG, each incorporating the Ingersoll-Rand SVG line of gas engine driven compressors. The Beaird units are complete plants, and include every component and control usually found in larger fixed compressor stations. The gas handling system, including scrubbers, piping, manifolds and cooling system, is gas-engineered for each plant. Each plant includes forced lubrication equipment; cooling system for oil, gas and water; compressed air starting system; surge tanks for water and fuel gas; and automatic safety controls.

Circle No. 23 on Postcard



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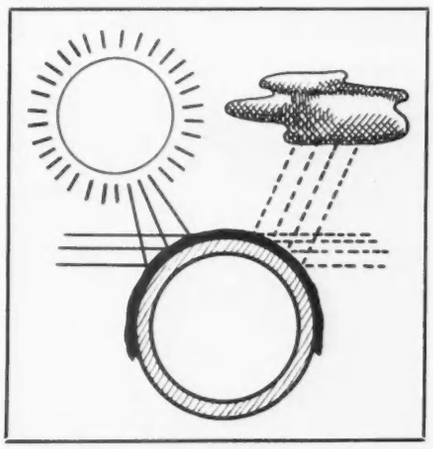
Pipe Coating

A Gilsonite asphalt base, asbestos fibre coating has been formulated by The Warren Refining & Chemical Company for use wherever corrosion from soil acids or air-suspended acids attack metal structures or pipe lines. Pro-Tek-To pipe coating is applied



cold, and can be used with or without conventional wrappings. It is impervious to severe temperature change and retains its mastic properties.

Circle No. 24 on Postcard

•

Wire Line Guide

A new wire line guide made by Collins Engineering Corporation hydraulically absorbs the whip and lash of the line encountered in drilling operations as line spools on and off drawworks drum at high speeds. It allows the line to spool evenly at highest speeds, preventing drum crushing, dog legs and line kinking. Hydraulic action is adjustable to suit any drilling requirement. The unit fits all standard or jackknife rigs.

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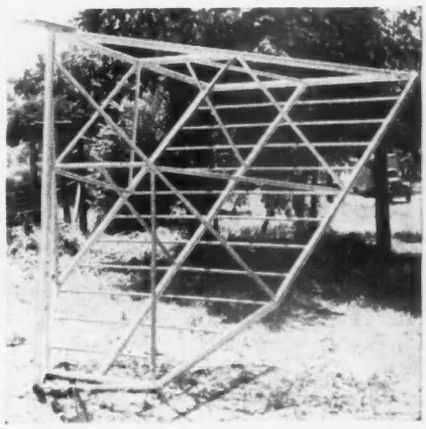

Welding Process

The pictured aluminum reflector screen frame for microwave transmission was fabricated by the "Heliarc" welding process developed by Linde Air Products Company. Two reflector screens at the top of each relay tower serve to reflect incoming waves to the repeater station at the tower base, and to reflect the outgoing wave from the tower to the next relay station. The screen must be accurately adjusted. Heliarc welding permits the accurate adjustment necessary to good transmission.

Circle No. 26 on Postcard

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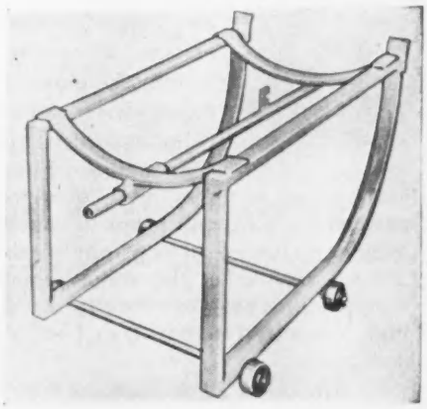
Drum Cradle

A "loading bar" facilitates loading drums onto the new barrel and drum cradle made by General Scientific Equipment Company. The cradle has wheels and is of all-steel construction.

Circle No. 27 on Postcard



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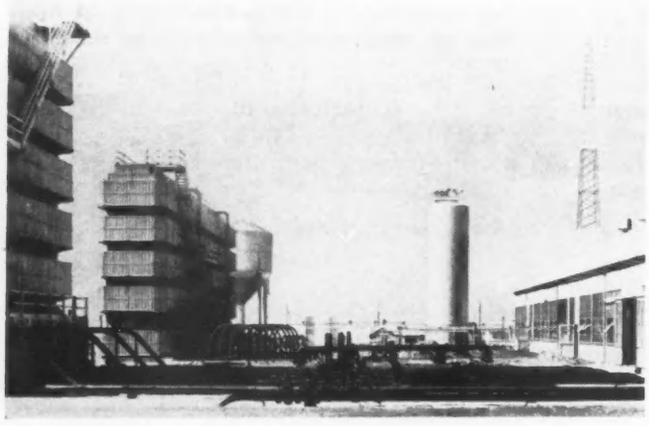
Cathodic Protection

Harco Corporation has installed a specially engineered cathodic protective system in this midwestern natural gas pumping station. More than 45,000 square feet of metal pipe surface is underground at this station, and soil conditions in the area are such that unprotected metallic pipe lasts on an average of from 9 to11 years. In installing the protective system, Harco engineers prepared three electrode beds utilizing a total of 80 National Carbon graphite anodes, and specified National Carbon Type BF-3 backfill material. General Electric rectifiers deliver an estimated power output of 130 amperes. A direct current impressed on the anodes radiates through the backfill material and soil to the metal pipe surface to prevent electrochemical action which corrodes metals.



Circle No. 28 on Postcard

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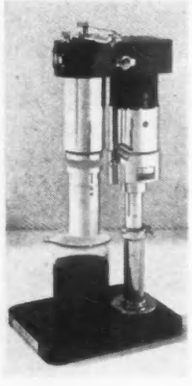
Viscosimeter

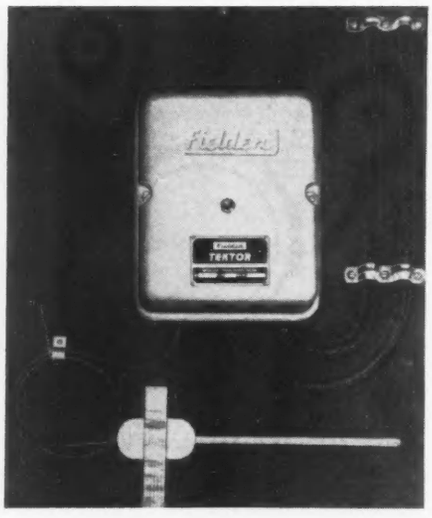
Geophysical Machine Works' Fann V-G multi-speed, portable viscosimeter weighs only nine pounds and may be operated from a six-volt car storage battery. It is a rotational type instrument with five speeds, electrically driven, permitting sustained rates of shear for any desired period of time. Measuring system employs a motor driven outer cylinder concentric with a stator. Fluid being tested occupies annular space between the two, and when the outer cylinder is turned at constant speed, exerts a torque on the stator which is proportional to the viscosity of the fluid. Viscosity range is from 1 to 150 centipoises.



Circle No. 29 on Postcard

Level Switch

Level control of practically all liquids and solids is made possible by the Tektor level switch manufactured by Fielden Instrument Corporation. No electrical contact is necessary with the material under control. Model AJ-1 Tektor is housed in a dust-tight, splash-proof, die cast aluminum box, 6½ x 7½ x 4 inches deep, with screw-on cover. A level differential of 1/32 inch up to 3/8 inch may be obtained. The electrode, connected to the instrument through a two-foot cable, consists of a simple probe, 4 to 6 inches long, which is inserted into the container at the level at which control is required.



Circle No. 30 on Postcard

Gauge Valve

Edward Valves, Inc., now offers a half-inch forged steel gauge valve series with male inlet and female outlet. The model is otherwise identical to the Edward gauge valves with female connections on both ends.

Circle No. 31 on Postcard

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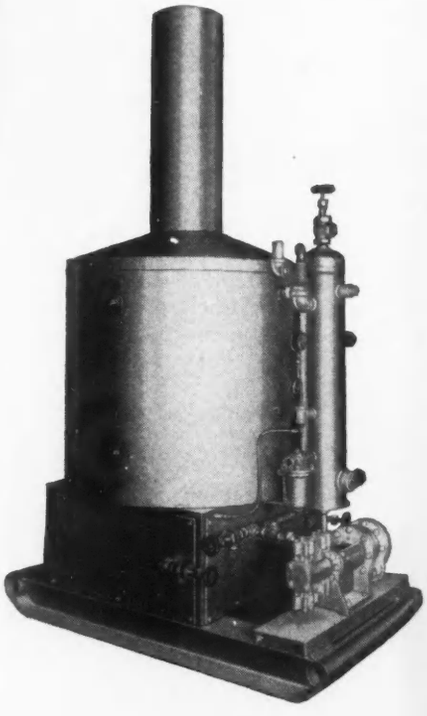
Oil Treating Boiler

Vanderlei Manufacturing Company is producing the Automatic Orifice Control Waterman Boiler, a complete unit for treating oil to remove water and change viscosity. It is made in 30 horsepower sizes and has a 200-pound working pressure wet or dry steam. Feedwater pump, burner, and necessary controls are an integral part of the burner. Electricity is required only for the oil-fired unit, which has an electrically operated blower. The explosion-proof unit develops full horsepower from cold start in less than five minutes. The feed system modulates the pump speed to fit the load requirements of the boiler.

Circle No. 32 on Postcard



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FORMATION PLUGGING
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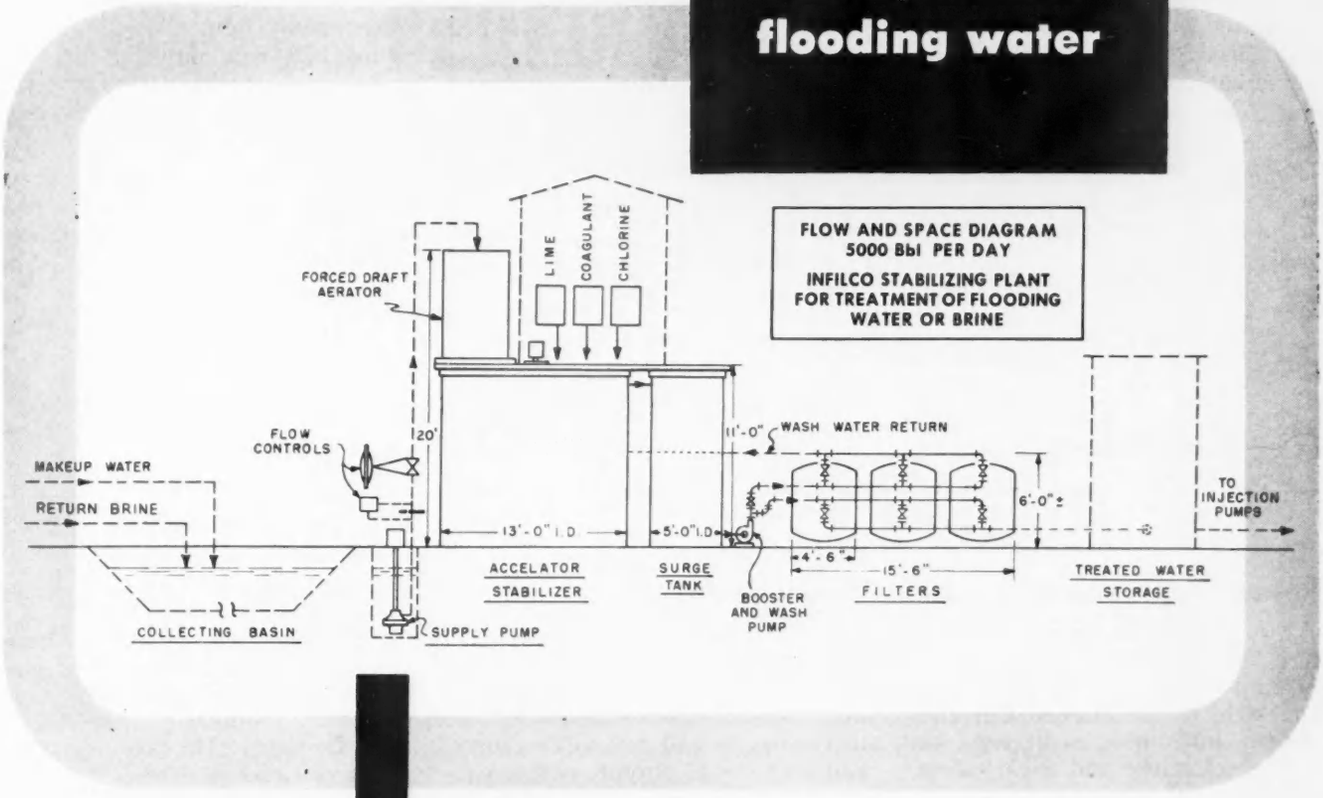
Infilco

plant delivers clear, stable flooding water



WRITE INFILCO FOR WATER ANALYSIS

No charge for scientific study of your flooding water supply with a prompt, complete report.

PROBLEM—

Plugging of underground formation by flooding water used for secondary oil recovery.

SOLUTION—

Installation of Accelator® stabilizing plant comprising forced draft Aerator, Accelator stabilizer, chemical feeders and controls, and filters.

RESULT—

Compact equipment, easily controlled, effectively clarifies and stabilizes flooding water, makes it non deposit-forming, has ended plugging.

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Mud Additive

"Kingseal", a mud additive made by Homer L. Twining and the W. E. Sievers Corporation, consists of wool, cotton, jute, synthetic fibers, wood fibers, and/or sawdust of varied and determined particle size. In cases of lost circulation, the sawdust starts a plugging action at the point where the clay particle has lost its efficiency. The fibers interlace and adhere to the thief formation, the manufacturers say, and the sawdust meanwhile fills in the interlaced accumulations until a sheath or plug has been formed.

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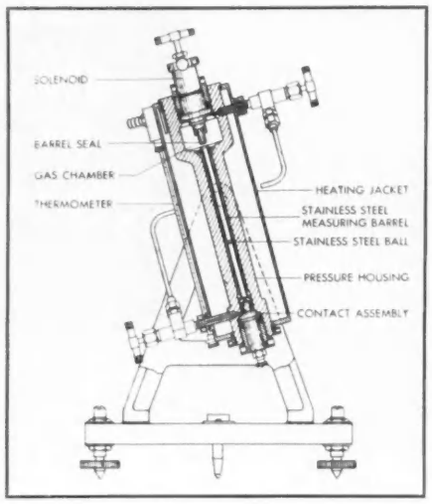

Viscosity Meter

Ruska Instrument Corporation is manufacturer of a recently-improved viscosity meter for determining the viscosity of bottom hole and surface fluid samples from oil wells. It is a rolling ball type unit for pressures and temperatures up to 10,000 pounds per square inch and 350° F. A measuring barrel made of 3/8 x .065 inch type 304 Carpenter stainless tubing contains the stainless ball. Seal mechanisms close the ends of the barrel while viscosity measurements are made.

Circle No. 34 on Postcard

New Literature

■ CONTINUED FROM PAGE 74

Power Plant Valves

A new reference bulletin describes cast and forged steel valves made by Edward Valves, Inc., for power plant use. Included are Edward Univalves, blowoff, instrument, non-return, cast steel check, globe and angle valves.

Circle No. 35 on Postcard

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Storage Tanks

The Diaflote, Hammond Iron Works' new liquid storage tank, is described in a new bulletin. The Diaflote's "Vulcalock" membrane is attached to the inside periphery of the tank, and rests on the surface of the stored liquid to act as a barrier between liquid and air, to prevent formation of vapors.

Circle No. 36 on Postcard

•

Compression Coupling

Morris Coupling & Clamp Company has issued a folder describing its new compression pipe coupling which is said to reduce turbulence at the joint.

Circle No. 37 on Postcard

Controllers

Brown Instruments Division's 16-page Catalog 8000 describes vane type electric contact control units used with the maker's Electr-O-Vane thermometers and pressure gauges, and with the ElectroniK potentiometer, as well as those employed in the new Pyr-O-Vane and Protect-O-Vane millivoltmeters, to give snap-action on-off, two- or three-position control.

Circle No. 38 on Postcard

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Protective Coatings

Protective coatings are among the five products made by Pittsburgh Coke & Chemical Company which are described in its new 12-page booklet, "Pittsburgh Chemicals."

Circle No. 39 on Postcard

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Enamel Finish Paint

Neolac "600" enamel finish paint, developed by U. S. Stoneware Company, is described in a new bulletin. It contains no lead, and is made with a new resin C-34 that gives fast-drying, hard-finish, high-gloss qualities.

Circle No. 40 on Postcard

Mechanical Products

"How the Products of Clark Serve Industry" is the title of a new illustrated, 32-page booklet which describes the products of Clark Equipment Company. The book includes a listing of Clark dealers.

Circle No. 41 on Postcard

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Coatings

A four-page technical folder available from The Wilbur & Williams Company contains a quick reference index for determining suitable coatings for rust prevention, chemical corrosion and dampness.

Circle No. 42 on Postcard

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Nickel Alloy Irons

A 36-page bulletin offered by International Nickel Company, Inc. discusses eight types of austenitic nickel alloy cast irons, their applications, and comparative service data in many industrial fields. The illustrated reference booklet contains tables of properties and corrosion data on nearly 400 conditions.

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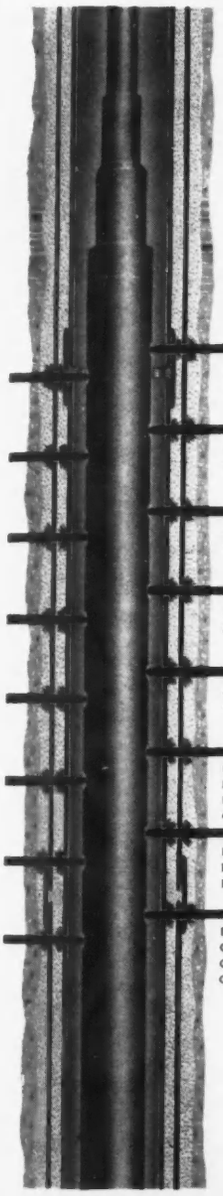
FOR *Better* PERFORATING SERVICE

JET SHOT OR BULLETS...

always call in

PERFORATING GUNS ATLAS CORPORATION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GREATER PERMEABILITY
SAFETY AT ANY TEMPERATURE
ACCURACY IN PLACING SHOTS
CLEAN HOLE WITH LESS BURR
EFFECTIVE PENETRATION IN SMALL CASINGS
LOWER COST PER BARREL OF PRODUCTION
FIELD PROVED ON 2 AND 3 CEMENTED CASINGS

When you're ready for perforating, you're ready for the pay-off. And that's when you'll find how much better the *complete* services of the Perforating Guns Atlas Corporation pay off!

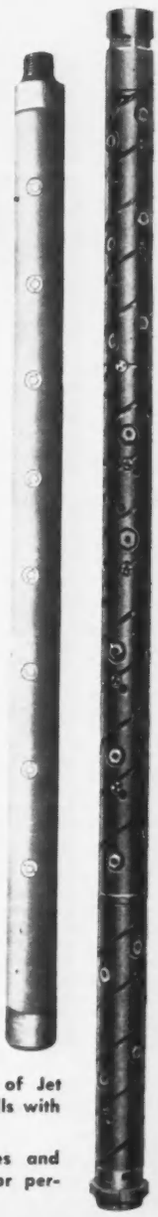
You'll find us ready for action on short notice, day or night. Our gun crews have 15 years of perforating experience behind them . . . they use the best equipment that money can produce . . . they travel fast to your well . . . they get in and out of hole *fast!*

And whether it's perforating with Jet Shot or Bullets, you'll find your designated formations accurately perforated—*exactly to your specifications.* Moreover, you'll find that our men know how to produce deeper penetration and cleaner holes with less burr . . . know how to produce greater permeability for increased oil flow . . . know how to produce effective perforation in small holes as well as through 2 or 3 cemented casings.

You call the shots and we'll deliver the holes! And we'll do it with safety at *any temperature.*

Perforating Guns Atlas Corporation also provides services for Gamma Ray Logging, and for wireline Baker Bridge Plugs and Baker Production Packers.

We'd like to perforate your next job . . . to show you *why* our services are preferred by so many oil companies. For any further details you desire, please telephone or write us today.



On left—one of many sizes of Jet Guns used for perforating wells with JET SHOT.

On right—one of many sizes and types of Bullet Guns used for perforating oil wells.

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Catalogs AND EQUIPMENT *Literature* OFFERED IN THIS ISSUE'S ADVERTISEMENTS

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CABLE TOOLS—Use and care of, Catalog. Acme Fishing Tool Co. See page 364.
Circle A2 on postcard.

MACHINE SHOP WORK—Acme Foundry & Machine Co. See page 366.
Circle A3 on postcard.

AERIAL MAPPING-MAGNETOMETER SURVEYS—Aero Service Corp. See page 325.
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BEARINGS AND PARTS—Aetna Ball and Roller Bearing Co. See page 359.
Circle A5 on postcard.

DIRECT FLOW PUMPS—Catalog. The Aldrich Pump Co. See page 367.
Circle A8 on postcard.

PUMPING UNITS—Catalog 151. American Manufacturing Co. of Texas. See page 6.
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SCALE AND RUST PREVENTIVE AND REMOVER—American Sand-Banum Co. See page 204.
Circle A15 on postcard.

CONE AND JUNK CATCHER—Data. Baash-Ross Tool Co. See page 149.
Circle B6 on postcard.

PIPE AND BOLT MACHINE—New Bulletin. Beaver Pipe Tools, Inc. See page 301.
Circle B14 on postcard.

SUCKER RODS — Literature. Bethlehem Steel Company. See page 183.
Circle C2 on postcard.

DRAWWORKS—Literature. Bethlehem Supply Co. See page 167.
Circle C3 on postcard.

EMULSION TREATER—Catalog. Black, Sivalls & Bryson, Inc. See pages 192 and 193.
Circle C5 on postcard.

SAFETY HEADS—Data. Blacks, Sivalls & Bryson, Inc. See page 297.
Circle C6 on postcard.

JUNK BASKET—S. R. Bowen Co. See page 333.
Circle C8 on postcard.

DRAWWORKS—Specifications. The Brewster Co. See pages 106 and 107.
Circle C9 on postcard.

PIPELINE ENGINES—Bulletins. The Buda Co. See page 231.
Circle C12 on postcard.

CASING HANGER—Catalog data. Cameron Iron Works, Inc. See Second Cover.
Circle D2 on postcard.

DIESEL POWER UNIT—Campbell & Cooper. See page 323.
Circle D4 on postcard.

POWER UNITS—Campbell & Cooper. See page 336.
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PORTABLE RIGS—Specifications and prices. Cardwell Manufacturing Co. See pages 60 and 51.
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UNIONS AND CHECK VALVES—Catalog 11. Catawissa Valve & Fittings Co. See page 380.
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DEPTHOMETER—Illustrated folder. The Cavins Co. See page 362.
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INDUSTRIAL ENGINES—Data. Chrysler Corp. See page 373.
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ENGINES—Data. Climax Engine and Pump Mfg. Co. See page 111.
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VALVES AND PIPING—Data booklet and training film. Crane Co. See page 43.
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CENTRIFUGES—Literature. W. H. Curtin & Co. See page 332.
Circle E8 on postcard.

PIPELINE GATE VALVES—Data and bulletin. Darling Valve & Mfg. Co. See page 274.
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INSULATING JOINT—Literature. Dresser Manufacturing Division. See page 293.
Circle E13 on postcard.

"NEOPRENE NOTEBOOK"—E. I. du Pont de Nemours & Co. See page 341.
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PUMPING ENGINES—Literature. Fairbanks, Morse & Co. See page 217.
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REGULATORS—Literature. Grove Regulator Co. See page 251.
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CASING HEADS—Bulletin No. 310-G10. Hercules Tool Co. See page 392.
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TUBING HEADS—Bulletin No. W-401. Hinderliter Tool Co. See page 391.
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PREFABRICATED BUILDINGS—Data Houston Ready-Cut House Co. See page 304.
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ENGINES AND COMPRESSORS—Data. Ingersoll-Rand. See page 365.
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ALLOYS—List of available publications. The International Nickel Co. See page 27.
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PUMPING UNIT—Catalog data. Jensen Bros. Mfg. Co. See page 214.
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HYDRAULIC JAR—Descriptive literature. M. O. Johnston Oil Field Service Corp. See page 393.
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PORTABLE DRILLING RIGS — Bulletin. Joy Manufacturing Co. See page 103.
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SAFETY FILLING CANS, OILY WASTE CANS —Catalog. Justrite Mfg. Co. See page 287.
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METAL STAMPINGS—Booklet. Kelley Manufacturing Co. See page 374.
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GRAVEL PACKING—The Layne and Bowler Co. See page 12.
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KNUCKLE JOINT OVERSHOT FISHING SYSTEM—LeBus Rotary Tool Works. See page 354.
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AUTOMATIC SAFETY PLUGS—Data. Lone Star Tool Co. See page 164.
Circle K13 on postcard.

WIRE ROPE—Bulletins 5134 and 5025. Macwhyte Company. See page 5.
Circle L2 on postcard.

GAUGES AND THERMOMETERS—Literature. J. P. Marsh Corp. See page 24.
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WEIGHT INDICATOR—Literature. Martin-Decker Corp. See page 114.
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CENTRIFUGAL PUMPS — Catalog. McGowan Pump Co. See page 378.
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PIPE COATINGS—Data. Middle West Coating & Supply. See page 303.
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SAND PUMPS AND BAILERS—Price list. Miller Sand Pump Co. See page 220.
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PLUG VALVES—Bulletin V-120. Nordstrom Valve Division. See pages 284 and 285.
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CASING HANGERS—Literature. Oil Center Tool Co. See page 361.
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PISTON RODS, PULLERS AND LOCK NUTS—Catalogs. Oil Well Mfg. Corp. See page 386.
Circle M14 on postcard.

PIPE LINE PUMPS—Booklet No. 13-51. Oil Well Supply Co. See page 8.
Circle M15 on postcard.

ELECTRIC PLANTS—Literature. D. W. Onan & Sons, Inc. See page 336.
Circle N1 on postcard.

PRODUCTION SAFETY VALVES — Literature. Otis Pressure Control, Inc. See page 211.
Circle N2 on postcard.

TUBING ANCHORS—Data. Page Oil Tools, Inc. See page 218.
Circle N4 on postcard.

CONDENSATE RECOVERY UNIT — Bulletins. The Parkersburg Rig and Reel Co. See page 190.
Circle N6 on postcard.

HYDRAULIC PUMPING JACK—Catalog. The Pelton Water Wheel Co. See page 207.
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PERFORATING SERVICE — Data. Perforating Guns Atlas Corp. See page 81.
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PARAFFIN SCRAPER—Data. Petroleum Specialty Co. See page 219.
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DITCHING MACHINES — Literature. Pewthers Ditcher Co. See page 298.
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AIRCRAFT—Brochure. Piper Aircraft Corp. See page 71.
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PROTECTIVE COATINGS — Data. Pittsburgh Coke & Chemical Co. See page 342.
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ROTARY HOSE—Catalog 6903. Raybestos-Manhattan, Inc. See page 155.
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Circle Q10 on postcard.

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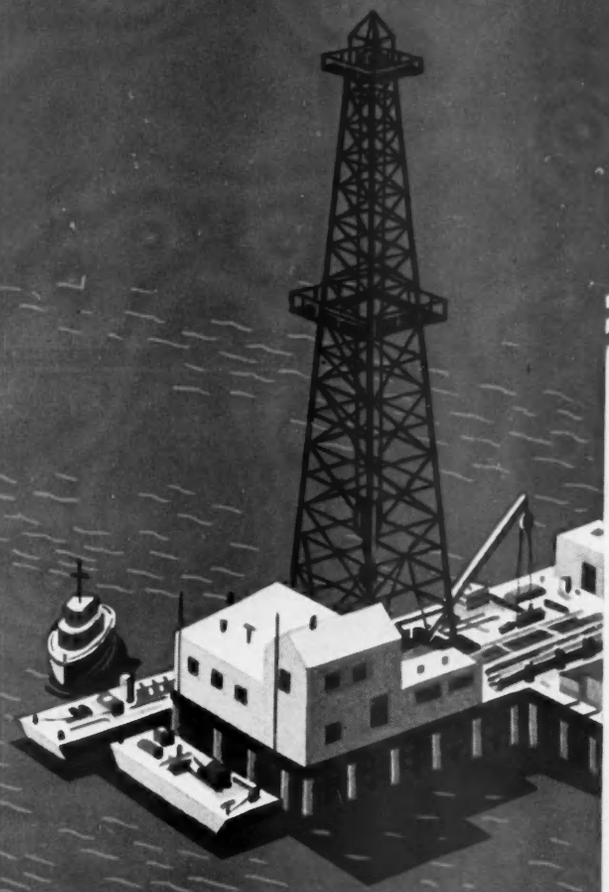
Exploration Section

L. J. LOGAN, SECTION EDITOR

WORLD OIL



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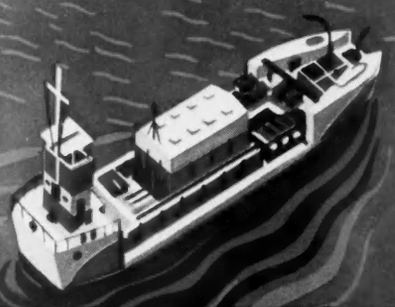

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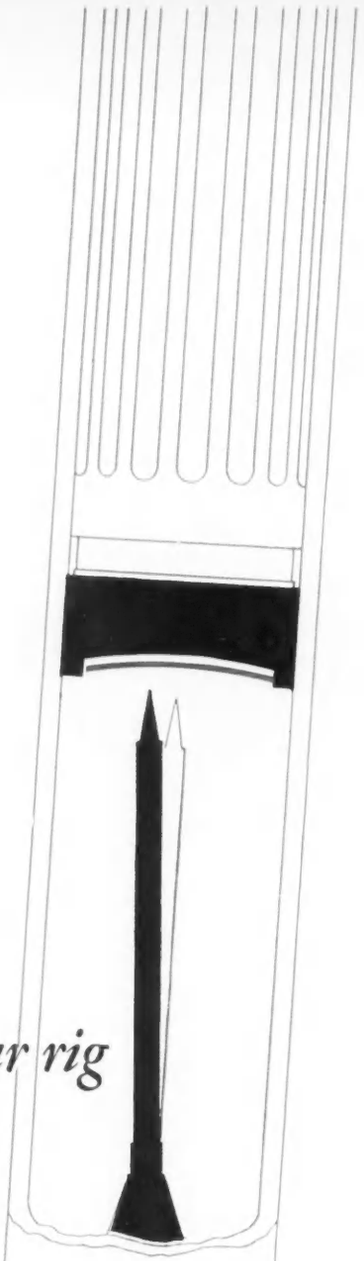

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Aerial Magnetic Oil Discoveries

By W. P. JENNY

Consulting Geologist and Geophysicist, Houston

DESCRIBED ARE some results of an aerial magnetic survey over a portion of the serpentine district in South Central Texas. Several local anomalies were selected from among the many indicated by the survey for further study and possible drilling. Ground micro-magnetic work very closely confirmed and further detailed the pictures obtained in the rapid air work. When these several areas were drilled, each was proved productive by the first well drilled.

THE Serpentine trend of Bastrop and adjacent counties in Texas had been successfully prospected for in the late 1920's and early 1930's by the ground magnetometer. With the advent of the airborne magnetometer, this trend was considered by Dr. R. W. Brauchli, vice president of Anderson-Prichard Oil Corporation, to be a logical district for a test of the new method.

An aerial magnetic survey over a 16-by-40-mile area was decided upon in 1947. The writer was entrusted with the supervision of the field work and with the interpretation. The field work was done in January and February of 1948.

This survey had a threefold purpose:

- To locate potentially productive plugs, which conceivably could

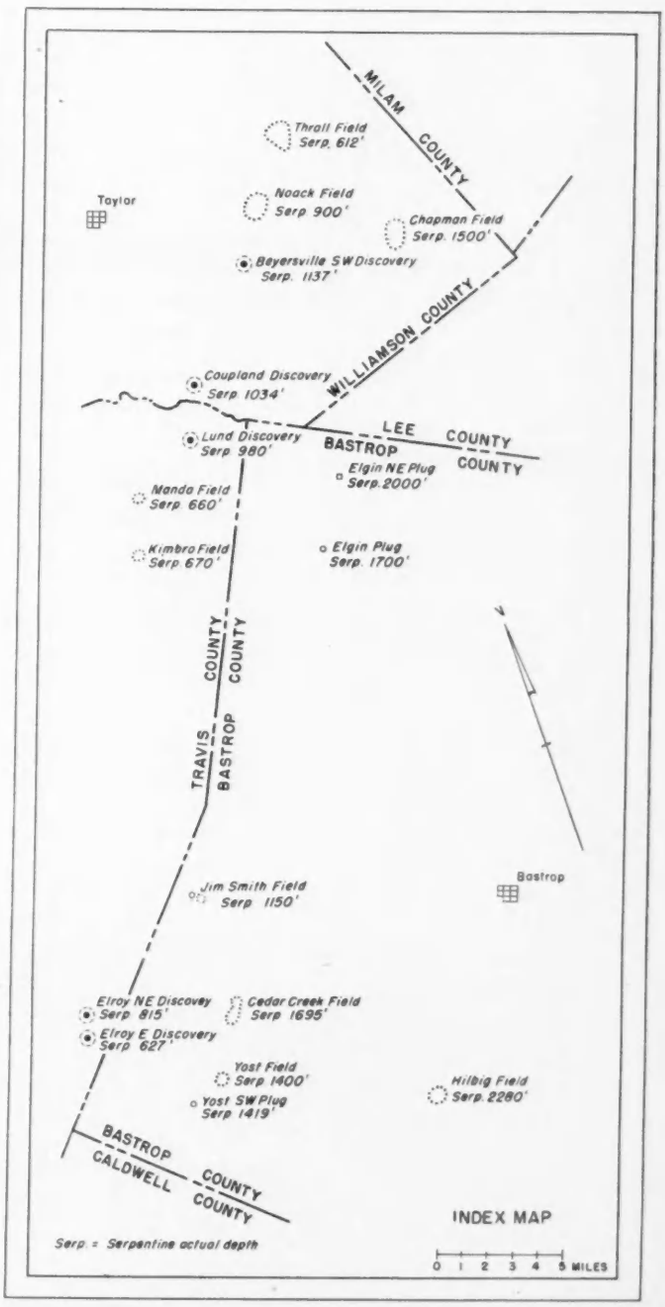


FIGURE 1.

have been missed by ground surveys, especially in areas of bad accessibility.

- To investigate present and future possible applications of the aerial magnetic method generally.

- To investigate the application of the principles of micromagnetic interpretation, as developed by the writer, toward aerial surveys.

In order to broaden the scope of the latter two points, a number of experimental flights were made over known structures upon conclusion of the Serpentine field work. The aerial profiles over the Benedum field, Upton County, Texas, which at that time consisted of only the discovery well, and over the Nash Dome, Brazoria County, Texas, are included in this paper.

Results of Serpentine Survey

The survey was made at an average above ground altitude of 1000 feet.

By surface geological and ground magnetic work a considerable number of Serpentine fields had previously been found within the area of the aerial survey. They all showed up distinctly in the aerial survey: Hilbig with 25 gammas; Yost with 24 gammas; Cedar Creek with 25 gammas; Chapman with 20 gammas; Thrall with 5½ gammas; Noack with 5 gammas; Manda with 15 gammas; Kimbro with 12 gammas. The dry plug at Elgin showed up as a 50 gamma anomaly.

Even by making allowance for the casing effect of the fields, these plugs could not have been missed by the aerial survey, since anomalies as low as 2½ gammas are clearly indicated by accurate aerial surveys, if properly interpreted.

Inasmuch as the Thrall field has produced more than 2⅔ million barrels of oil from a depth of 600 to 900 feet, it seemed advisable to test three similar anomalies, which had been located by the aerial survey along the general trend through Thrall.

In order to check the accuracy of the aerial field work and interpretation and also in order to pinpoint the respective first locations, it was decided to make limited ground micromagnetic surveys over these three prospects.

The results of these three aerial and ground micromagnetic surveys are shown in Figure 2. The three tests resulted in the discovery of three producing areas. Later drilling showed them to be of minor commercial significance, but they proved a point of major potential importance, namely that aerial micromagnetics can successfully locate even minor structural anomalies.

Since micromagnetic ground anomalies as produced by sedimentary structure are of a similar order of intensity and are derived from similar depths as these three Serpentine anomalies, it was only logical to presume that such sedimentary structural anomalies could also be located by aerial surveys.

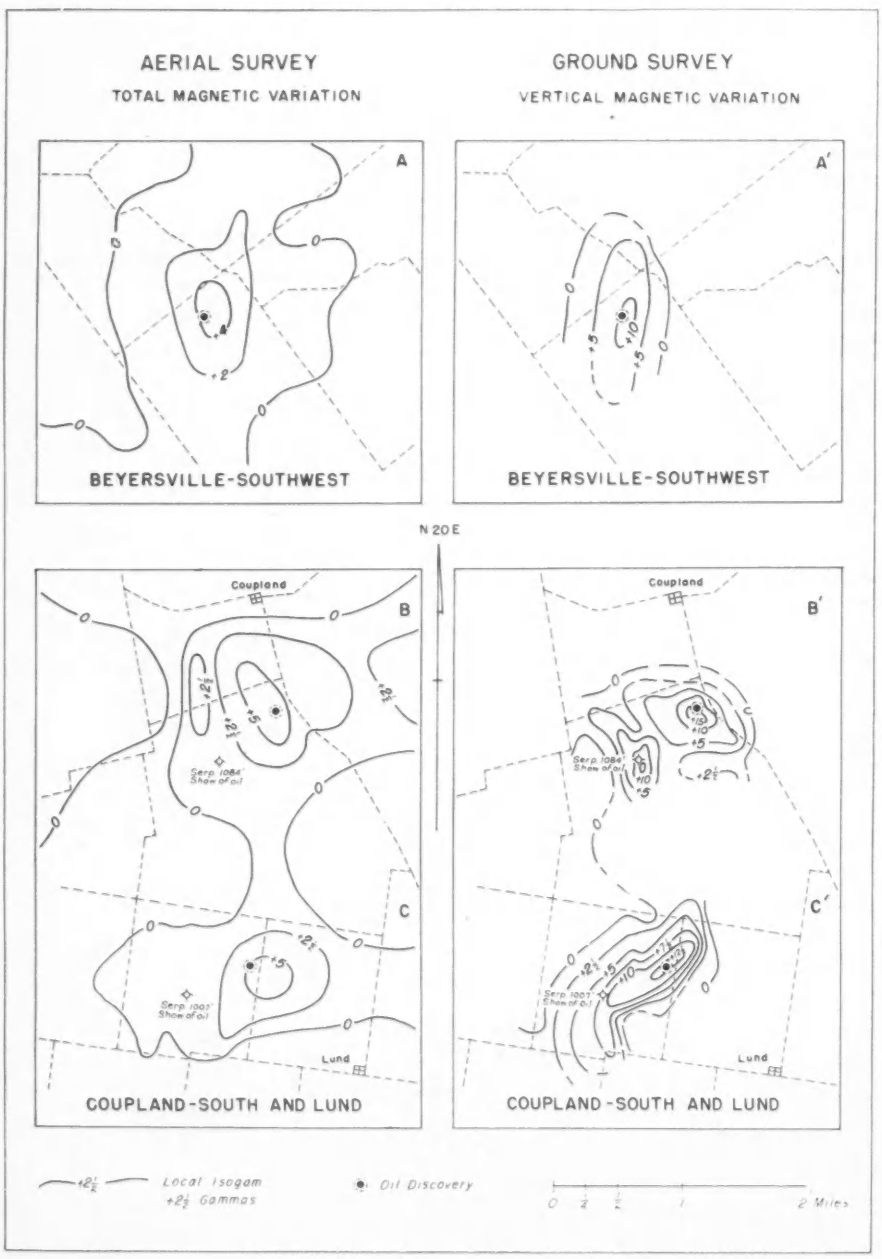


FIGURE 2.

First Discovery

To the knowledge of the writer, the Lund discovery of December, 1948, was the first oil found which could directly be credited to the airborne magnetometer.

A well southwest of the Lund discovery and another well southwest of the Coupland discovery proved extentions or twin plugs, as postulated by the respective ground surveys. **These wells demonstrate the obvious fact that, under normal conditions,**

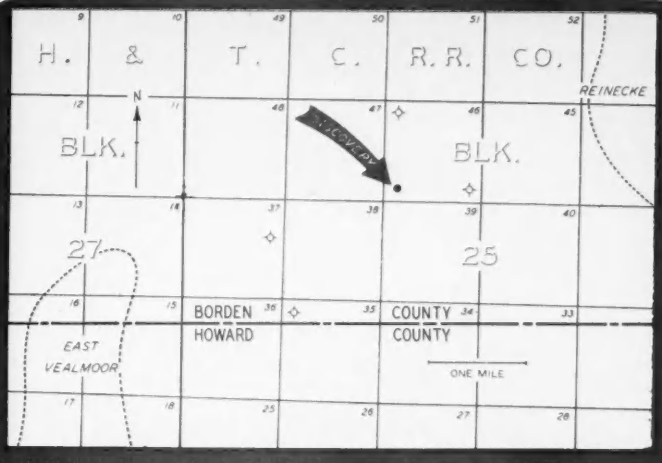
Are you looking for Reefs?

OIL

A Pennsylvanian lime strike in southeastern Borden County was indicated when Lario Oil & Gas Co. 1 T. L. Griffin, in 46-25-T&TC, five miles north of Vincent, flowed clean 46 gravity oil for about two hours at an estimated rate of 20 to 30 barrels hourly on a drillstem test from 7,095-7,110 feet.

Flow was through a half-inch choke. No. 1 Griffin topped the Pennsylvanian reef lime at 7,100 feet. The Lario prospect is believed to be on a structure apart from the Reinecke field, two miles east and three-quarters of a mile north.

TULSA WORLD
July 9, 1951



The Client's subsurface expectations were confirmed by SSC's reflection survey.

THE RESULT: A new Pennsylvanian reef discovery in southeastern Borden County, Texas.

Lario Oil & Gas Co. 1 T. L. Griffin, southwest of the Reinecke field and in the southwest corner of Section 46, developed oil on a drill-stem test of the Pennsylvanian reef between 7,095-7,110 ft.

Top of the reef, which had drilled extra soft, was placed at 7,100 ft., on elevation of 2,381 ft. That top was approximately 70 ft. high to dry holes in the northwest and southeast corners of the same section. On the test, gas surfaced in 5 minutes and clean, 46°-gravity oil in 11 minutes. The well made a steady flow of 2 hours, at an estimated rate of 30 bbl. hourly. Operators were to run surveys before setting casing.

OIL and GAS JOURNAL
July 12, 1951

Summarizing SSC's Approach to SUCCESSFUL Reef Exploration, the following fundamental procedures are recommended:

1. Complete Geological and Geophysical Coordination.
2. Detailed Surface and Sub-surface Coverage.
3. Highest Record Quality.
4. Detailed and Thorough Interpretive Technique.
5. Isopach Analyses.
6. Velocity Analyses.

The necessity for detailed seismic surveys and a careful, thorough analysis of all seismic data are emphasized. Also the examination of well samples and electric or radioactive logs often indicates a rapid variation of the sediments in the proximity of organic reefs. Thus, the need is stressed for complete cooperation between geological and geophysical personnel in order to maintain a successful reef exploration program.

Seismograph Service Corporation

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more details will be observed, if the survey is made at, or close to, the ground level.

A somewhat stronger aerial and ground micromagnetic anomaly about two miles southwest of the Yost field is shown in Figure 3A. It was tested with the result that dry Serpentine was encountered at 1419 feet.

Double Anomaly

A large aerial anomaly in southeasternmost Travis County showed up as a double anomaly in the ground survey (Figure 3B). The first test on the main anomaly was abandoned on account of mechanical difficulties. The second test discovered a commercial field at 627 feet. The smaller anomaly was tested later and was found to be productive at a depth of 815 feet.

All of the above-mentioned anomalies lie along or close to good roads; and, with the sole exception of Lund, there had been done considerable previous drilling close to these prospects. The nearby wells did not, however, disclose the presence of Serpentine plugs.

Flying at Different Levels

The magnetic effect decreases at the inverse third power of the distance for a magnetized spherical body; at the inverse second power of the distance for a magnetic pole; at the inverse first to second power of the distance for a sheet-like magnetized body.

On the other hand, the magnetic effect of a magnetized bed or surface of infinite horizontal extent is the same for any depth of this bed or surface.

By surveying at different levels the depth and shape of the source of a magnetic anomaly may therefore be determined. The anomaly may be produced by structural, stratigraphic or petrographic conditions, or by a combination thereof.

The resolving power of the magnetic method is so much increased by surveys at different levels that the writer does not think it is any longer advisable to make interpretations, especially on a regional scale in unfamiliar areas, without at least a few profiles surveyed at different levels.

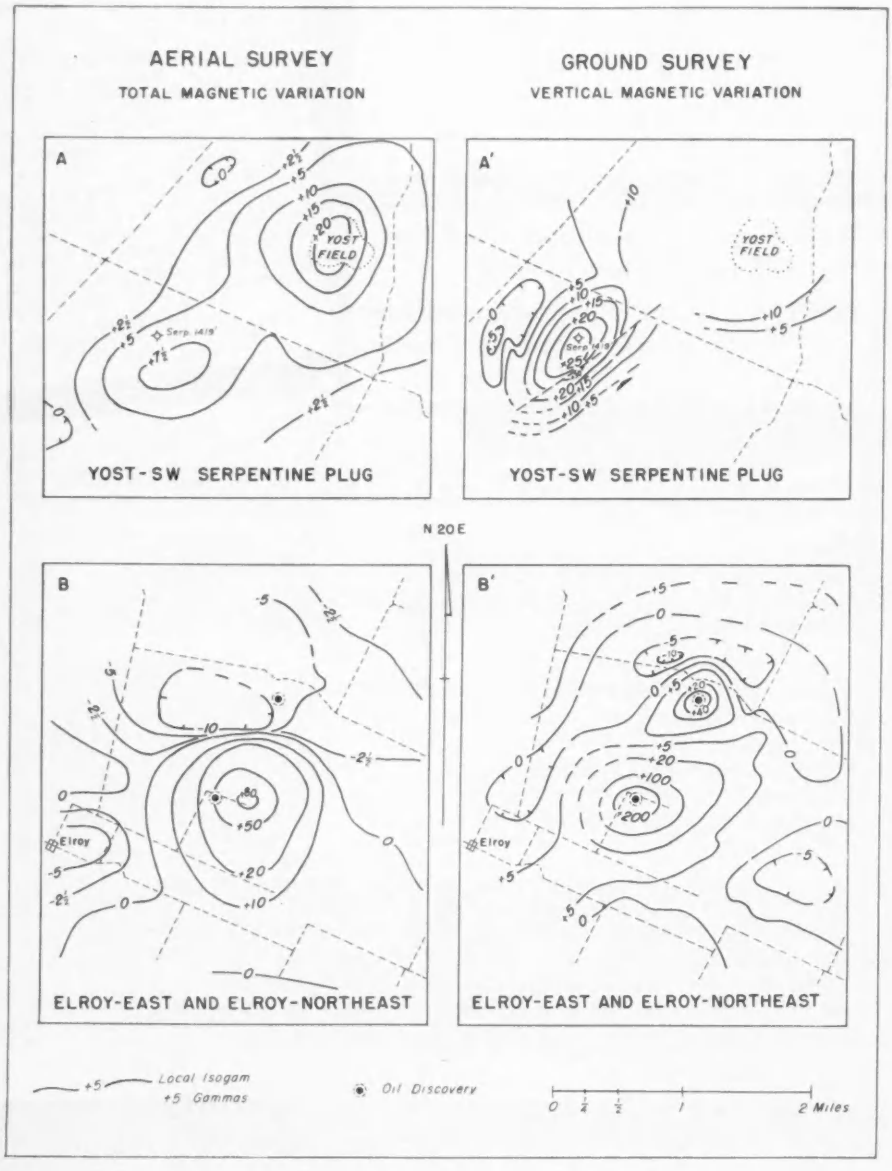


FIGURE 3.

Experimental Profiles

A number of experimental profiles were flown at 2000 and at 500 feet above ground in addition to the standard 1000-foot a.g. level for the Serpentine survey. Some of the results are shown in the Figures 4 and 5.

Figure 4 shows three sets of 1000 feet a.g. and 500 feet a.g. profiles from Manda eastwards toward and beyond points north of Elgin. The profiles are parallel and about one-half mile distant. The most northerly profile shows also the ground magnetometer profile for the small Elgin-N plug, which had previously been discovered. Dry Serpentine was there encountered at some 2000 feet.

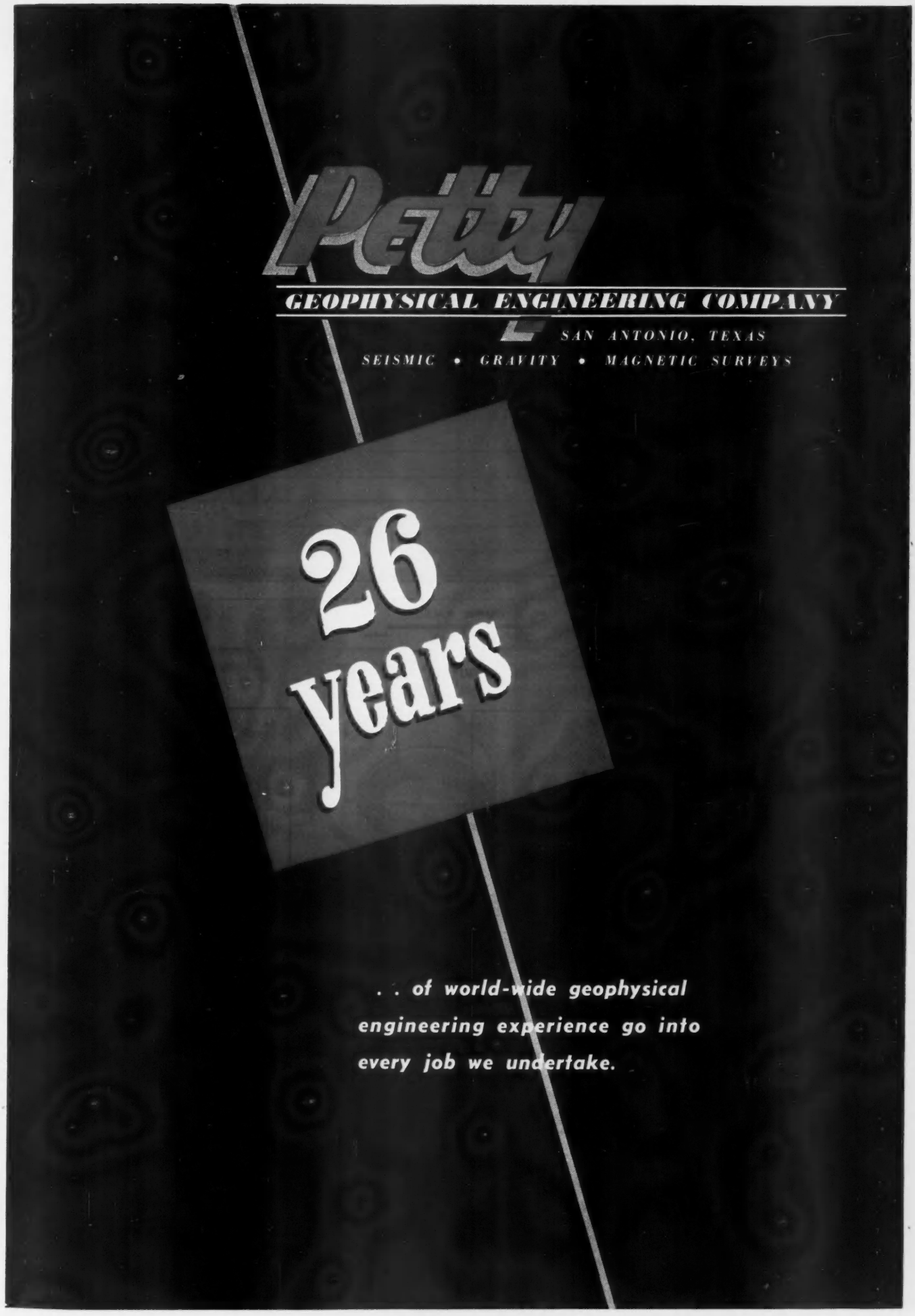
Figure 5 shows a set of profiles at 1000 feet a.g. and 500 feet a.g. over the Cedar Creek plug and over the Jim Smith plug.

The Cedar Creek field was discovered in 1933 by ground magnetometer. Top of the Serpentine was found at 1695 feet, production at 1707 feet.

The Jim Smith plug was discovered by Humble Oil & Refining Company in the early 1930's. Dry Serpentine was drilled into at some 1150 feet. Recently some production was found on the eastern flank of this plug.

Benedum and Big Lake Fields

The Benedum and Big Lake fields, Upton-Reagan counties, Texas, lie over large igneous Basement Uplifts, which are indicated by magnetic positive anomalies of about 200 gammas at 1000 feet a.g. as shown by Figure 6. The artificial field effect at Big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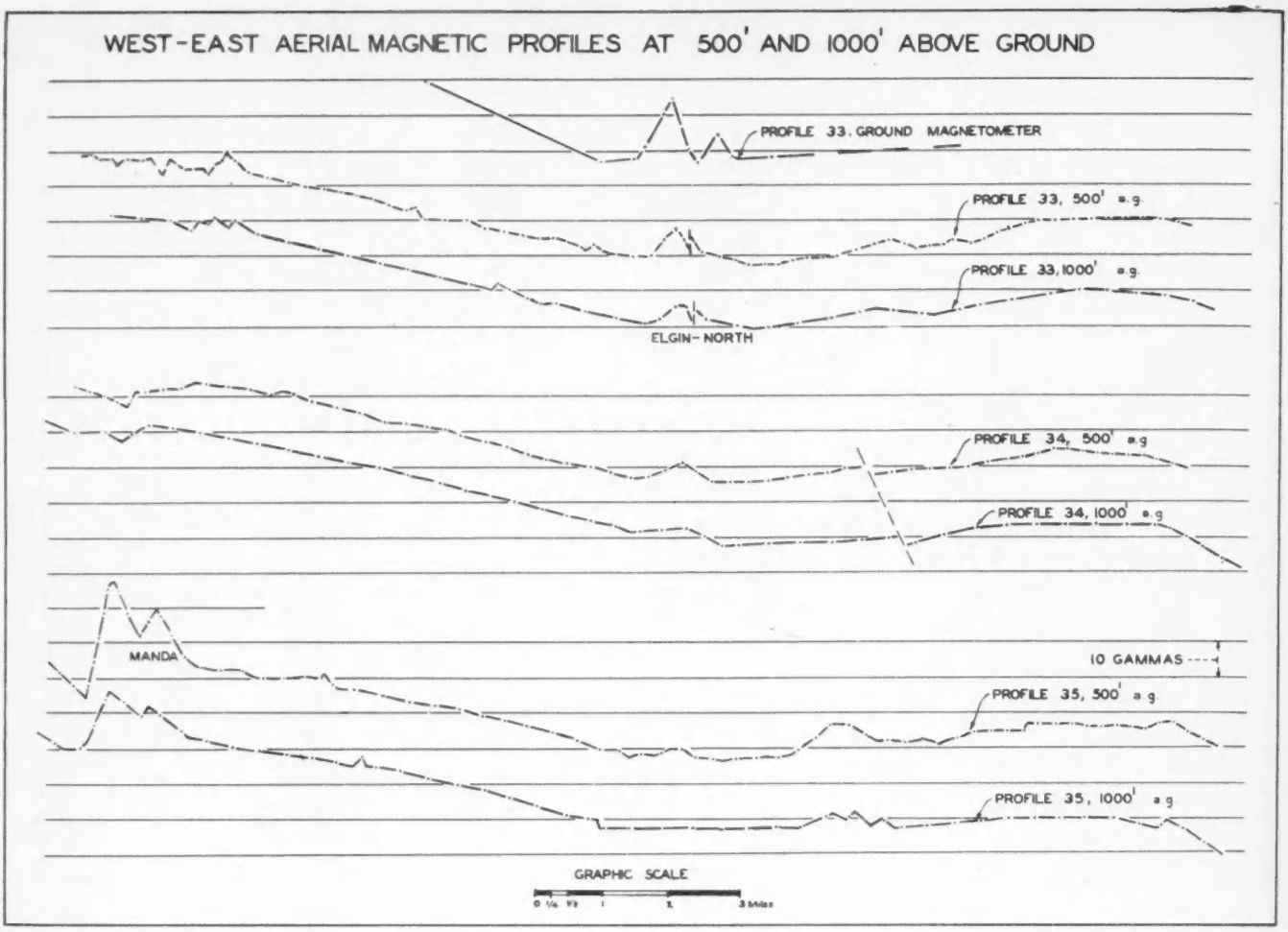

FIGURE 4.

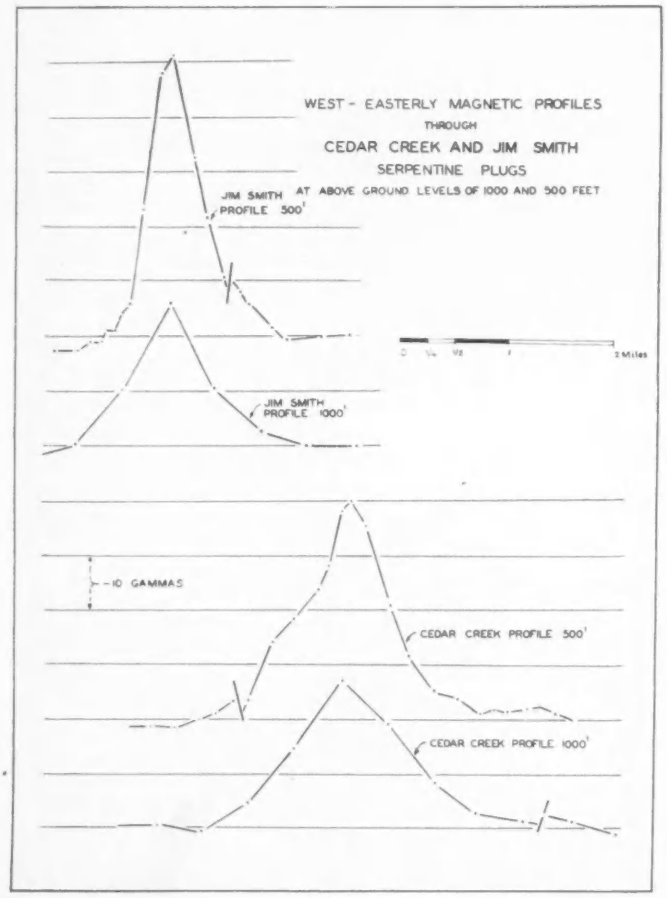

FIGURE 5.

About the Author

DR. WILLIAM PAUL JENNY, consulting geologist and geophysicist, Niels Esperson Building, Houston, has served in this capacity for the past 20 years. Previously, he was in charge of geophysics for Magnolia Petroleum Company at Dallas. Dr. Jenny came to the U. S. in 1925 as geophysicist for Shell Oil Company. He has a doctor's degree in geology from the University of Zurich, Switzerland. He also studied at the University of Geneva, Switzerland.

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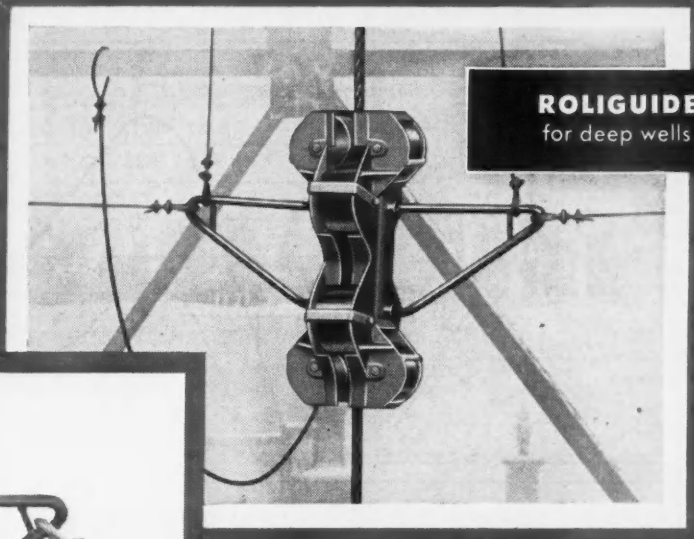

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Lake is practically eliminated in Profile 4, which was flown at 2000 feet a.g. The Benedum field consisted at the time of the survey of only the discovery well and three drilling wells, the effect of which is negligible in this size anomaly.

Midway between points A and B along Profile 1 is a secondary magnetic high, which is indicative of the recently discovered Flat Rock field.

The results of this survey should leave no doubt about the value of magnetic prospecting in West Texas —three highs, three fields.

Salt is non-magnetic, even slightly negative magnetic. Certain beds within the sedimentary section are slightly magnetic. If a salt dome intrudes into and displaces such magnetic beds, a weak negative anomaly can be observed over the dome. This negative anomaly is usually accentuated by the fact that on account of the salt uplift, magnetic sedimentary beds are brought closer to the surface along the edge of the salt mass. We may therefore expect a positive rim zone surrounding a negative central area over the dome.

The ground and 1000 foot a.g. profiles over the Nash Dome, Brazoria County, Texas, are shown in Figure 7. As in previous two-level surveys we notice a considerably stronger indication at the ground level than at 1000 feet a.g.

ACKNOWLEDGMENT

The writer is indebted to Anderson-Prichard Oil Corporation for the release of the aerial and ground micromagnetic Serpentine surveys; to Fairchild Aerial Surveys, Inc., for the release of the Benedum and Nash profiles; to Dr. R. W. Brauchli and to K. A. Simmons for their criticism and suggestions; also for their pioneering interest in the potentialities of aerial micromagnetic prospecting, which made these investigations possible.

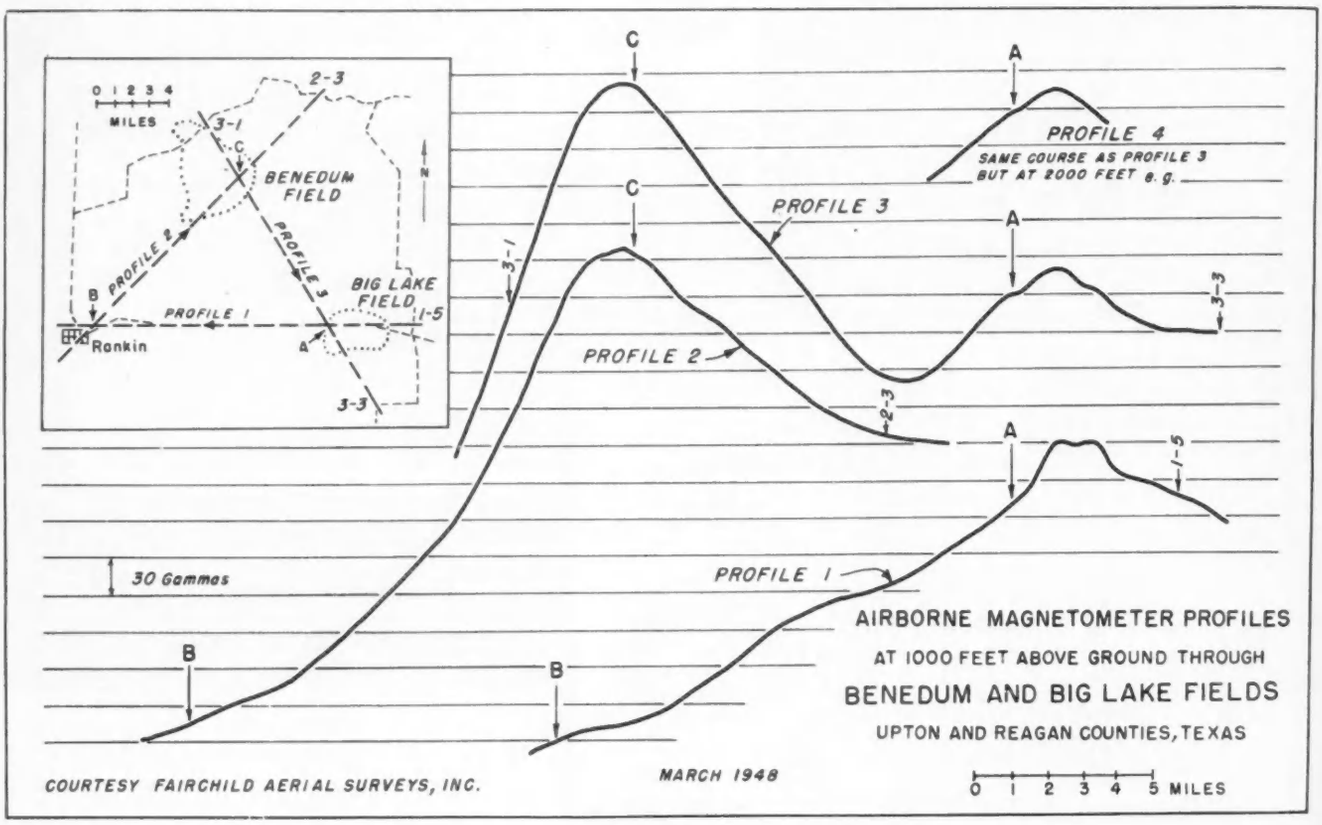

FIGURE 6.

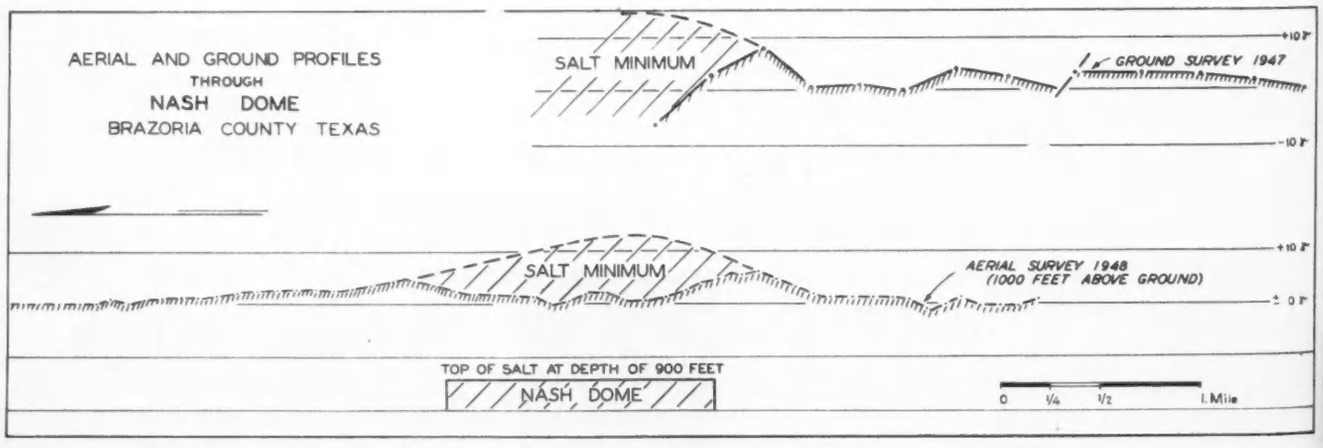

FIGURE 7.

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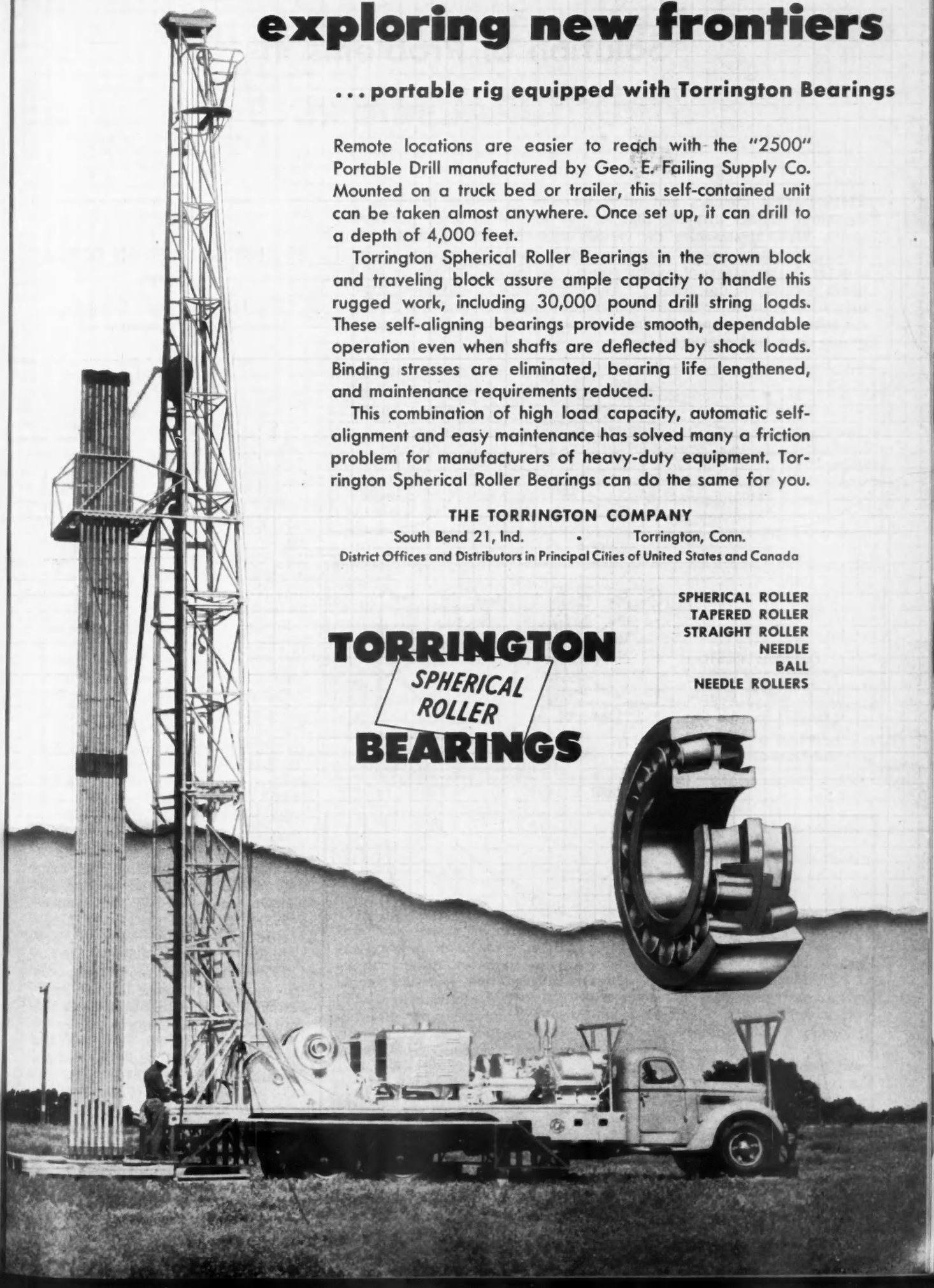

Trigonometrical and Graphical Solution of Problems in STRUCTURAL MAPPING

THIS PAPER discusses and offers solutions to certain problems in structural contour mapping that are not treated in other published works. While summarizing the various cases that can be involved in making structural contour maps, the article especially presents a solution for the projection of control points onto the key horizon on steep flanks normally to dip (Case c). The article offers a convenient trigonometrical solution for the problem and also suggests a practical graphical solution. The paper should be a useful reference for geologists, geophysicists, and engineers.

By LUIS GUILLERMO DURAN
Engineer,
The Texas Petroleum Company,
Bogota, Colombia

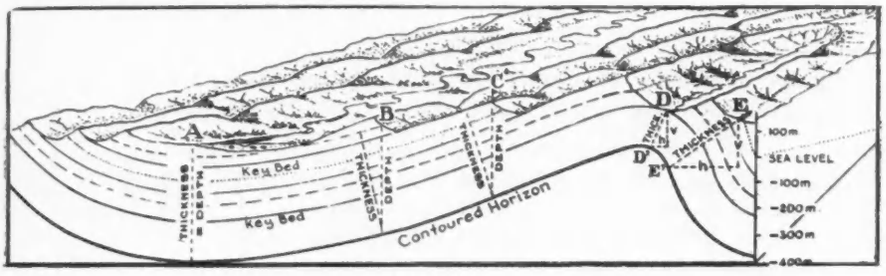

FIGURE 1

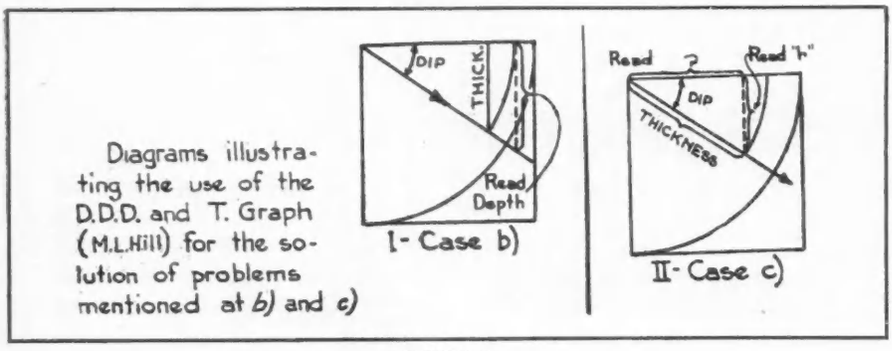

FIGURE 2.

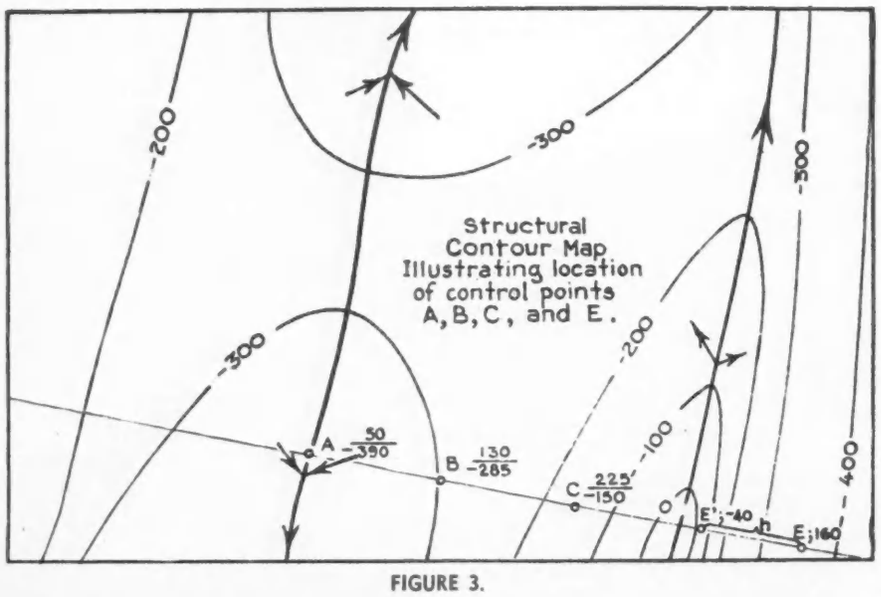

FIGURE 3.

ALTHOUGH the coustruction of structural contour maps is more or less extensively discussed in textbooks and treatises on petroleum geology and related subjects, the problem of the projection of control points on steep flanks, normally to dip, is not mentioned in any of those works known by the writer. However, this procedure is necessary in order to avoid the excessive error that the cosine formula yields in these cases.

Principal purpose of this article is to offer a convenient trigonometrical solution for the problem referred to, suggesting also a practical graphical solution for the same, based on the use of M. L. Hill's D.D.D. and T. graph. This graph was published in the *Bulletin of the American Association of Petroleum Geologists* (No. 6, 1942), and the reader must resort to that publication for actual use of the graph.

For general details about the construction of structural contour maps the reader is referred to the well known books of W. H. Emmons (1931), B. Willis (1934), D. Hager (1938), F. H. Lahee (1941), M. P. Billings (1942), and L. W. LeRoy (1950). For a discussion of the error involved in the cosine formula in relation with thickness and depth calculations, see Hobson's paper in the AAPG Bulletin (No. 12, 1942) and the present writer's papers in *Petroleo Interamericano* (April 1948) and *The Oil and Gas Journal* (Feb. 17, 1949).

The Problems and Their Solutions

The general problem in structural contour mapping is the conversion of

■ CONTINUED ON PAGE 98

Oil Is HOW You Find It

Part 2—CONCLUSION

By DR. ROBERT W. WHEELER
Wheeler & Ingraham, Dallas

CONSIDERING several alternate approaches to the subject of the allocation of responsibility in prospecting for oil, it is clear that all geologists, proceeding from a background of academic interest in the science of geology, who have chosen to apply geologic reasoning to the oil business have thereby accepted a heavy responsibility to improve their techniques and judgment for the specific purpose of helping to advise exploration for oil.

The oil industry gauges its progress on a strictly financial basis. What are the financial benefits that the industry must anticipate in the employment of geologists? Probably a great deal less than half of the 7000 petroleum geologists in the U. S. are employed in an advisory capacity, although it would seem that most geologists at least assist in the amassing of data that goes into the final judgment of the merits of a prospect.

Consider the subject from a third angle. What are the responsibilities and incentives to a geologist who has gained technical experience and refinement of judgment at oil company expense? Should he not enhance his value by taking the initiative in advancing opinions as to the merits of his own and other company prospects?

Among the philosophical aspects of the relation of geologists to the oil industry, there is actually a social problem. It has often been stated (by geologists) that they are underpaid compared to such advisory professions as those of medicine and law.* Whether this is true or not, at least the judgment of a really competent geologist can reap fabulous rewards compared with his salary or consulting fees. The social distinction is quite evident; by and large, geologists do not enjoy the professional esteem of doctors and lawyers. Let us analyze the reasons for this anomaly in professional stature.

Is it fair to suppose that geologists as a whole do not exhibit the intellectual prowess of the practitioners of biology, chemistry, physics and mathematics? Probably the fairest observation is that it requires a special mental experience and an imaginative mind to be able to decipher from notoriously inadequate data the chances that (1) a drilling venture will find oil and (2) be profitable.

But is it not possible that oil geologists may be dodging on one hand the rigorous requirements of the scientific method and avoiding on the other the responsibility of an economic return for the oil company investment? The oil geologist has let himself get into an unhappy position he is beyond the academic world, and still not a responsible participant in a business enterprise. The oil companies are partly to blame in relegating the individual to positions in a large organization where originality of ideas, initiative and self-expression (beyond the specialized definition of the job) may be regarded as presumptious; where, indeed, seniority and political indulgence all too commonly take precedence. Where initiative has not been welcome, one observes with dismay that a geologist of promise may have abandoned the route of self-expression and turned to a policy of cautious avoidance of opinion and a fear of criticism.

THE FIRST PART of this article was concerned with the geological approach to evaluating prerequisites for oil accumulation. This article is intended to help advance the professional status of the petroleum geologist. It considers philosophical aspects of the geologist's relation to the oil industry, and reaches the conclusion that geologists have not assumed the full responsibility that is implied in their advisory capacity in the search for oil.

Attitude of Other Departments

Another important contributing factor to the doubtful status of the oil geologist is the attitude of other departments participating in the exploratory program. These are quick to perceive the inherent weaknesses in the geologic approach to oil finding. They note the uncertainties of opinion that may arise from unprovable inferences, and the growing caution that arises from a record of occasional failures in a sequence of enthusiastically recommended prospects. All in all, competitors for credit in getting oil out of a wildcat prospect have done their best, with considerable success, to segregate the credit for oil reserves among each other at the expense of geologists.

Thus, in an acceptance of medioc-

* Dr. C. W. Tomlinson, in a personal communication, comments on this point as follows, "Only a small proportion of those now practicing petroleum geology have gone through so lengthy a formal education as is true, for example, either of physicians or of most lawyers. Even among them, public esteem depends chiefly upon actual achievement."

rity,* the oil geologist permits himself to give away annually millions of dollars worth of valuable data and ideas to such outside competitors as request his opinion. This is generally the total consideration.

This sense of mediocrity is not altogether self-imposed. It has been vastly enhanced with the cooperation of (1) the seismologist who can measure structural closure with greater accuracy; (2) the reservoir engineer who claims to be better able to evaluate porosity, permeability, gas/oil/water saturation and ultimate productivity; (3) the production man, who selects the services and equipment to allow the oil into the production string and hence to the surface for pipe line disposal; and (4) the landman officiating for the venture who was able to make the success more economical by trading down the acquisition cost of acreage (the bonuses and commissions) and who claims much credit for the niceties of a brilliantly consummated deal. None of these contributions had anything to do with the probability of discovering oil nor much to do with the profitability of the venture.

The route to self-respect is by clarification of the factors that lead to oil discovery and profit through an appreciation of the limitations of the geological approach. The various geologic factors that are prerequisites for profitable oil accumulation should be classified and weighed, and applied in a consistent fashion to each prospect. Then, having thoroughly investigated all of the available evidence bearing upon the merits of the prospect, let the geologist pass judgment and let the statistics of exploratory drilling take care of the outcome. There is not the slightest justification for self-consciousness under the interrogation of non-technical participants in the drilling or production ventures, any more so than is embarrassment justified on the part of the lawyer who loses a questionable lawsuit or despair in a doctor who loses a hopeless medical case. So far as geologists learn well the techniques and shortcomings of their profession, they shall gain self-esteem and the respect of the industry.

*Note: This paragraph has aroused much comment. The stigma of "mediocrity" has been criticized by such outstanding geologists as Hubert Bale and Professor Levorsen who feel that capable geologists have clearly earned the respect of the industry. Equally strong is the support of others who feel that oil companies have not always appreciated the geological contribution to oil finding either in the encouragement of initiative or in the dispensing of responsibility, credit and salaries. But the main argument here is that the geologist can rise above the system by becoming more proficient and by seeking more responsibility. On the other hand, we owe a great debt to the oil industry—to this cooperative enterprise of technical experts, scientists and businessmen that has opened to geologists the combined opportunities of scientific research and a useful career in the interests of national welfare.

About the Author

DR. ROBERT R. WHEELER, Dallas oil operator and consulting geologist, has served in various geological capacities with Shell, The Superior, Eason and Burton Oil Companies in the Mid-Continent-West Texas oil province. Geological contributions concern Cambro-Ordovician stratigraphy in the Adirondack region and El Paso-Van Horn area; geology and oil possibilities of the Delaware Basin, West Texas, and the Anadarko Basin of Oklahoma; stratigraphic convergence traps and problems of the origin of continents and mobile belts. He is a member of the Sigma Xi chapter at Harvard University, where he received a doctorate in 1942, and is listed in American Men of Science, 1949.

Geological Career

While some geologists continue to specialize, others expand their realm of interest and experience and become increasingly qualified for the broad responsibilities of management in the oil industry. It is evidently a product of the geological background that makes them logical recipients of administrative positions. These mental properties include an insatiable curiosity and a capacity for imagination which, however, is tempered by an appraisal of the economic implications of an original idea at the expense of enthusiasm. More important, the geologist develops a style of reasoning based largely upon speculation and the inherent unprovableness of geologic conclusions. Thus, he is better able to reason without mathematical limitations and he is possibly better able to face, without prejudice, the ever-changing problems of originating and directing the economic policy of the oil business.

In his advisory capacity, passing judgment upon oil investments, he begins to realize through his contacts with the other departments participating in oil exploration that he must learn some of their techniques and problems. For example, the geologist has, for decades, invaded what might be called the province of the field engineer who, although a student of higher mathematics and strength of materials, may be neither versed in nor curious regarding the subsurface geological problems encountered in a drilling well. Thus the geologist frequently decides when, where and how to core an interesting zone, and chooses the type of drill-stem testing device and packer seat. He may even advise the driller as to the type of rock bits or coring equipment that should be used according to his predictions as to the hardness and other lithologic characteristics of the formation. Likewise, he may dispute the practices of a chemical engineer with regard to the physical and chemical properties of the drilling mud in order to leave practical instructions for the drilling superintendent based upon an understanding of the subsurface geology.

Long ago the geologist was forced to become adept in the interpretation of electrical and other logging records. Similarly, he was obliged to comprehend the techniques and the limitations of core analyses and, having access to the well cuttings, the cores, the drill-stem test results, the drilling time and the electric logs, he is in the best position to judge permeability, porosity, oil and connate water saturation and, in brief, all of the reservoir attributes that one might suppose were strictly within the province of the reservoir engineer. As noted earlier, the geologist is in the best position to recommend production techniques such as acidization, liquid fracturing or nitroglycerin treatment with his highly technical knowledge of lithology. The texture may be due to crystallization, dolomitization, oolicastic porosity, coquina or the calcareous bond of a clastic reservoir, so that his opinions are important in outling a program for treating and producing the well.

Law Training

Just as he has been obliged to invade practically every phase of the field of petroleum engineering, he has also had to learn as much about the law as practical in such special fields as (1) contracts, in order to fulfill all of the obligations set out by partners in an exploratory enterprise that deals with drilling, testing and pro-

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ducing of partnership oil wells; (2) equity, such that he comprehends the stipulated, as well as the implied, covenants of an oil and gas lease form, and appreciating the obligation to either drill or release acreage that is being drained by offset wells, he is in a position to advise the operator of the economics of the two possibilities; and (3) testimony, for the geologist is frequently called as an expert witness before state, county and federal tribunals to justify the operator's plans for well spacing, for production techniques, unitization, ultimate recovery, etc. He learns to discern that which may be called hearsay and that which is competent evidence.

If he is lucky, his frequent contact with the land department may give him an opportunity to observe the trading for leases and drilling deals, the sale of partial interest, the value of offset acreage, the dry hole contributions, etc.

It is easy to see that when the geologist is called in to advise a great exploratory program, for example, in a new province, all of this background is very helpful. To be aware not only of a great range of geological complexities which may be encountered, but also to be personally experienced in leasing, drilling and production problems places the geologist in an enviable position. He is able to estimate the probabilities of finding structural and/or stratigraphic traps, their range in drilling depths and density across the province. He is the one to estimate the quality of reservoir objectives and the indications that the province is petroliferous by appraisal of probable source beds, seeps and shows of oil. He is the only one who can decipher historical geologic events and their genetic import in creating, through episodes of orogenic movement and sedimentation, the requirements for oil accumulation. He is the one to decide upon programs of surface mapping or core drilling for shallow possibilities or for geophysical programs to map the deeper possibilities beneath the regional unconformities.

Advantageous Position

Finally, as a program of exploratory drilling has been established in close cooperation with the land and engineering personnel, he will be in a position to analyze critically and interpret every technical and economic phase of the venture. He can now view, more with sympathy than with chagrin, the current success of the one-out-of-thirty wildcatters who, unincumbered with an understanding of the intricacies of subsurface faults, wedge-outs and facies changes and undaunted by the painful statistics of the probabilities of failure, proceeds blithely ahead, refinanced, on his program of dubious prospects. This is the operator who will tell you that "oil is where you find it." But the geologist has learned that, for every doubtful factor in the analysis of a drilling venture, he will have to drill at least one additional failure to reap the statistical rewards of discovery success. In short, he knows that oil is how you find it.

Two outstanding advocates of the importance of imagination and intestinal fortitude in the search for oil prospects, Ira H. Cram and A. I. Levorsen, stress the desirability of finding an excuse to drill exploratory holes. If a reader should get the impression from this article that wildcats should not be drilled without satisfactory evidence of the factors necessary for oil accumulation, he would completely miss the point, namely, that wildcats must be drilled year after year on less adequate advance information as oil becomes harder to find. Working his geological imagination overtime, he is not apt to fish out of thin air some new and unheard of criterion for oil accumulation, but performing at maximum capacity, he is simply trying to determine to what extent the known prerequisites for oil can be ascertained before drilling.

With broadening experience, he passes final judgment on the merits of a drilling program for he has considered every geologic and economic angle; and if it be a failure, it is to be regarded as a single item in a series of ventures from which he expects the operator to gain the long range benefit of good judgment. And if he turns down a deal or farms out a prospect which fails to meet these standards and if this prospect ultimately is productive, the same statistical reasoning is valid. The essence of this philosophy was beautifully stated more than 2000 years ago:

> "There is nothing more profitable for a man than to take good counsel with himself; for even if the event turns out contrary to one's hopes, still one's decision was right even though fortune has made it of no effect; whereas if a man acts contrary to good counsel, being lucky, he gets what he had no right to expect, his decision was not any the less fallacious."
>
> —Herodotus

(Last of Two Parts)

Structural Mapping Problems

■ CONTINUED FROM PAGE 94

surface elevations of points on key-beds, to elevations of points located vertically below these, on the horizon to be contoured. The required data for the calculations are the key-bed dips and the thicknesses or stratigraphic intervals between the key-beds and the contoured or datum horizon.

Three general cases may occur (See Figure 1):

a) The beds are horizontal. In this case (point A) thickness and depth are equal.

b) The beds have a uniform inclination. In this case (points B and C) the depth to the datum horizon may be found by the relation:

$$\text{Depth} = \text{Thickness} \times \text{sec. Dip} \qquad (1)$$

or, by using Hill's D.D.D. and T. graph (application 5) as illustrated in Diagram I of Figure 2:

c) The beds have varying dips within relatively short horizontal distances, as in steep flanks of fairly tight folds. In this case (points D and E) the surface point must be projected onto the datum horizon along a line normal to the plane of the bed, instead of vertically, since the depth calculation by equation (1) would involve a large error, as can be easily understood from inspection of Figure 1. Thus, in order to have the point projected onto the contoured horizon, on the map, as well as its elevation, it is necessary to calculate the components h and v, which are given by the formulas:

$$h = \text{Thickness} \times \text{sin. Dip} \qquad (2)$$

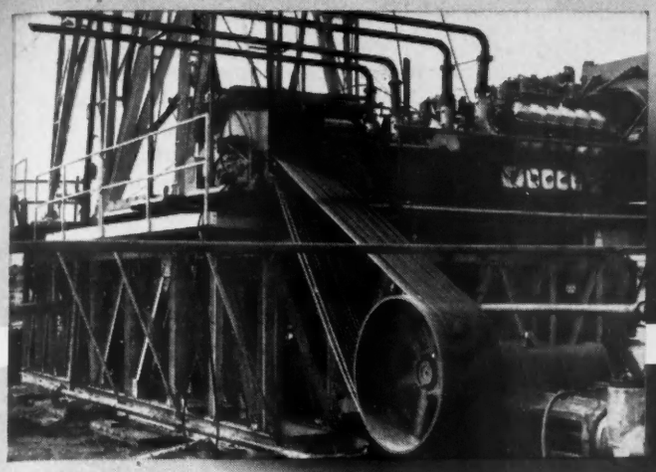
$$v = \text{Thickness} \times \text{cos. Dip} \qquad (3)$$

or, they may be found graphically by using the D.D.D. and T. graph, in the manner illustrated by Diagram II of Figure 2.

Figure 3 illustrates the positions of the points considered on the final structural contour map, with the exception of D, which was omitted for the sake of clearness. It can be seen that E′ is the projected position of E onto the datum plane, by means of h, and that its elevation was obtained by subtracting v from the surface elevation of E.

ACKNOWLEDGEMENT

The writer wishes to acknowledge indebtedness to R. B. Wheeler, geologist of the Texas Petroleum Company, for the friendly opportunity given in 1942 to work in the computations related to structural maps, wherein the interest of the writer in this subject arose.



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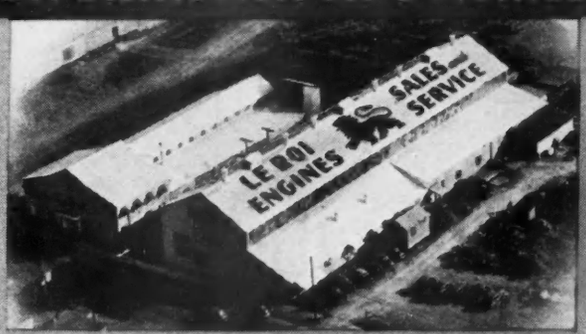

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Exploration in September Accounts for 1008 Wells

EXPLORATORY drilling activity continued on a high level during September, and the resulting 1008 completed wells were the second highest number ever completed in a single month. The all-time high of 1031 was set a month earlier.

This year is well on the way to becoming the most active exploration year in history, with wells completed during the first nine months leading those drilled during the same period of record-holding 1950 by 23.7 percent.

Even though September trailed August in total wells, records show its efforts were more successful. A total of 177 of September's tests were rated as commercial producers for a score of 17.6 percent of the total drilled. August's record-breaking 1031 tests produced only 169 successful wells for a tally of 16.4 percent.

The month's exploratory efforts resulted in the opening of 119 new oil pools. Those were comprised of 78 new fields and 41 new pay horizons in established fields. Also included were seven distillate pools and 22 new gas pools. All three classes of discoveries topped August's finds. Major extensions to fields totaling 29 in September slightly trailed August's 31.

During the first nine months of this year, 7807 exploratory wells were completed, and that represented an increase of 23.7 percent over the 6311 credited to the comparable period of last year. However, to date only 18.4 percent have been successful, while 19.4 percent hit the pay during the earlier period.

Summary of Results of Exploratory Drilling

ITEM	Sept., 1951	Aug., 1951	NINE MONTHS: January-September 1951	1950	Percent Diff.
Oil Discoveries	119	112	986	802	+ 22.9
New Fields	78	87	719	592	+ 21.5
New Pays	41	25	267	210	+ 27.1
Distillate Discoveries	7	6	63	66	— 4.6
New Fields	5	4	43	52	— 17.3
New Pays	2	2	20	14	+ 42.9
Gas Discoveries	22	20	161	110	+ 46.4
New Fields	15	15	126	96	+ 31.3
New Pays	7	5	35	14	+150.0
Total Discoveries	148	138	1,210	978	+ 23.7
Extensions to Fields	29	31	223	247	— 9.7
Oil Fields	21	29	174	218	— 20.2
Distillate Fields	2	1	14	8	+ 75.0
Gas Fields	6	1	35	21	+ 66.7
Total Prod. Tests	177	169	1,433	1,225	+ 17.0
Dry Holes	831	862	6,374	5,086	+ 25.3
Wildcats	812	831	6,088	4,902	+ 24.2
New Pays	1	1	11	7	+ 57.1
Outposts	18	30	275	177	+ 55.4
Total Expl'tory Tests	1,008	1,031	7,807	6,311	+ 23.7
Percent Productive	17.6	16.4	18.4	19.4	.....
Percent Dry	82.4	83.6	81.6	80.6	.....

Results of Exploratory Drilling in September and First 9 Months, 1951-1950, by Districts

State or District	MONTH OF SEPTEMBER, 1951													FIRST NINE MONTHS, 1951																
	Productive Tests										Unproductive Tests				Productive Tests									Unproductive Tests			Total Dry		Total Exploratory Tests	
	New Fields			New Pays			Extensions			Total Productive			Total Exploratory Tests		New Fields			New Pays			Extensions			Total Productive						
	Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas		Wildcats	New Pays	Outposts		Oil	Dis.	Gas	Oil	Dis.	Gas	Oil	Dis.	Gas	9 Mo. 1951	9 Mo. 1950	Wildcats	New Pays	Outposts	9 Mo. 1951	9 Mo. 1950	9 Mo. 1951	9 Mo. 1950
Alabama											6			6				1			2			3	2	16			16	14	19	16
Arizona											1			1												3			3	4	3	4
Arkansas	1				1		1			3	10		2	15	4		1	8	1		3			17	9	67		8	75	68	92	77
California	4			7			1		2	14	38	1	2	55	22		2	21			10		3	58	43	328	4	30	362	285	420	328
Colorado	1									1	20		1	22	5		3			1				9	7	86		3	89	37	98	44
Florida																										3			3	8	3	8
Georgia																														4		4
Idaho																										1			1	3	1	3
Illinois	6			2			4			12	90			102	23			15			37			75	89	552			552	536	627	625
Indiana	5			4		1				10	48			58	31			9		1	2			43	39	280		1	281	372	324	411
Kansas	9			2						11	68			79	116		7	22						145	83	601			601	440	746	523
Kentucky	3									3	22			25	13			7			7			27	17	144			144	71	171	88
Louisiana	2	1	1				2			6	35		2	43	26	5	4	15	3	4	12	1	1	71	67	245	1	18	264	171	335	238
North Louisiana	2	1					1			4	21		2	27	15	1		4	1	4	6	1	1	33	21	160	1	8	169	82	202	103
South Louisiana			1				1			2	14			16	11	4	4	11	2		6			38	46	85		10	95	89	133	135
Maryland																									1				1		2
Michigan	2									2	30			32	9		4	1		1	1			16	28	231			231	212	247	240
Mississippi	1			2			1			4	16		3	23	7	2		4	1		1			15	13	104		8	112	108	127	121
Missouri											1			1												1			1	3	1	3
Montana											5			5	1						4			5	3	34	1	5	40	40	45	43
Nebraska	1									1	15			16	7			1			2		4	14	9	55		5	60	42	74	51
Nevada																										2			2		2	
New Mexico	2		2							4	10			14	13		9	4			2		1	29	22	54		7	61	57	90	79
North Dakota											1			1	1						1			6		6			6		7	
Ohio											4			4							1		4	5	4	20			20	9	25	13
Oklahoma	7	1	1	2			4			15	54			69	55	2	7	19	2	1	27	2	2	117	124	491			491	378	608	502
Pennsylvania																	1							1	1						1	1
South Dakota																														6		6
Tennessee																										6			6	4	6	4
Texas	33	3	11	20	1	6	8	2	4	88	320		6	414	376	34	85	130	13	26	57	11	20	752	641	2655	5	176	2836	2117	3588	2758
Dist. 1 S. Central	1			1		1	1			4	14			18	17		4	2		1	5		1	30	15	156		12	168	147	198	162
Dist. 2 Middle Gulf		1		2	1	1		1	3	9	22		1	32	10	10	11	20	3	10	5	3	7	79	51	159	1	27	187	118	266	169
Dist. 3 Upper Gulf	3	1	4	6						14	22			36	19	9	20	25	2	3	2	1	2	83	79	205		4	209	180	292	259
Dist. 4 L. Gulf-S.W.			3	2		3	2		1	11	32		1	44	22	6	19	29	6	9	7	1	7	106	77	268	1	27	296	220	402	297
Dist. 5 E. Central	1			2						3	4			7	5	2		6			7			20	8	116		2	118	53	138	61
Dist. 6 Northeast		1	1	1				1		4	7			11	6	4	1	2			1	6		20	17	66		3	69	60	89	77
Dist. 7-B N. Cent.	16		3	3		1				23	114			137	135		20	14		1	4		2	176	142	743		13	756	470	932	612
Dist. 7-C W. Cent.	4			1			2			7	26		1	34	44	1	3	5	2		6			61	39	225		6	231	152	292	191
Dist. 8 West	5			1			1			7	26			33	47		4	13			10			74	100	274	3	13	290	222	364	322
Dist. 9 North	3			1			2			6	41		3	50	68	2	1	14		2	10		1	98	112	416		68	484	488	582	600
Dist. 10 Panhandle											12			12	3		2							5	1	27		1	28	7	33	8
Utah											3			3	2									2	2	19			19	13	21	15
Washington																														2		2
West Virginia																		2						2		2			2		4	
Wyoming	1			2						3	15		2	20	8		1	10		1	6			26	21	82		14	96	81	122	102
Total U.S.	78	5	15	41	2	7	21	2	6	177	812	1	18	1008	719	43	126	267	20	35	174	14	35	1433	1225	6088	11	275	6374	5086	7807	6311

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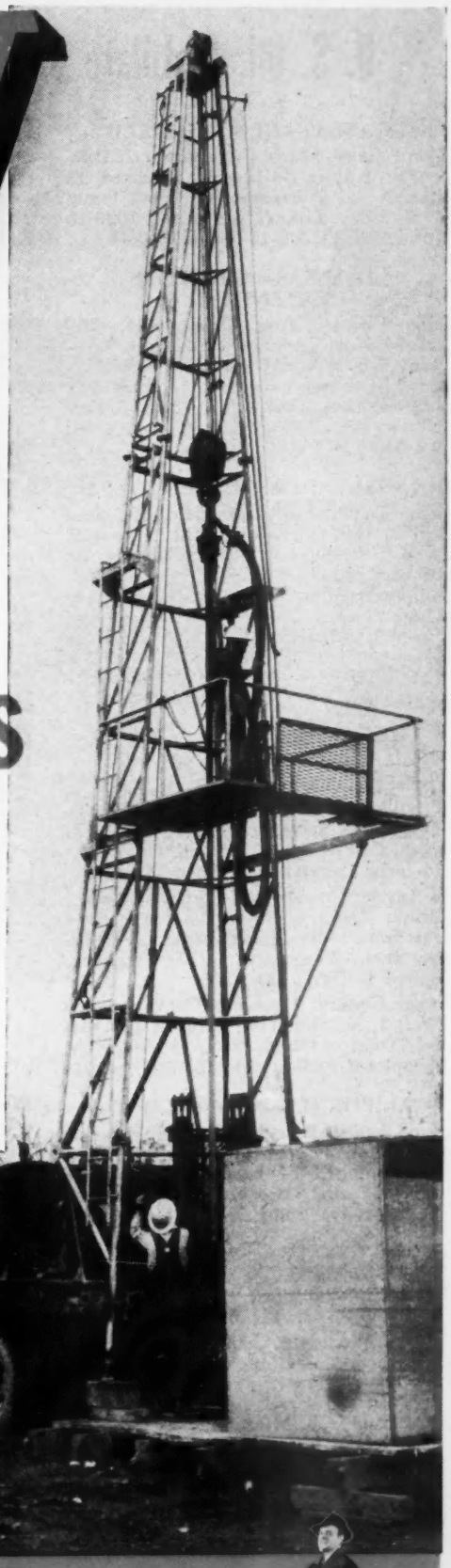

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U. S. Oil, Distillate and Gas Discoveries and Extensions in September

ARKANSAS—NEW OIL FIELD

Union County. Murphy Corporation's Robertson 1-A, in 33-18s-14w, pumped 18 barrels and 15 barrels water from Travis Peak lime, Lower Cretaceous 3620-26 feet, completed 9-15-51, TD 4006.

ARKANSAS—OIL FIELD EXTENSION

Union County, Bear Creek field. McAlester Fuel Company's Southern Company 1-B, NW NW SW 4-16s-17w, 1½-mile northeast extension, pumped 114 barrels from Travis Peak lime, Lower Cretaceous 3780-89 feet, completed 9-8-51, TD 4010.

ARKANSAS—NEW DISTILLATE PAY

Miller County, Fort Lynn field. Stanolind Oil & Gas Company's Miller Land & Timber Company 1-A (OWWO), in 20-18s-27w, flowed 61 barrels and 2.3-million from Upper Rodessa lime, Lower Cretaceous 6056-65 feet, 65.5-gravity, ¼-inch, completed 9-15-51, TD 6359.

CALIFORNIA—NEW OIL FIELDS

Fresno County. Santa Fe Drilling Company's Dyson 1, in 6-17s-20e, pumped 104 barrels from 5825-6093 feet, 33.8-gravity, completed 9-9-51, TD 6576.

Kern County. Gilliland Oil Company & C. O. Davis' Strode 2, in 15-25s-18e, flowed 130 barrels from Point of Rocks sand, Eocene 3183-3250 feet, 35-gravity, ¼-inch, completed 9-22-51, TD3335.

Los Angeles County. Ted Sterling's Rynne-Fisher 1, in 35-5n-17w, flowed 124 barrels from Mohnian sand, Miocene 4632-96 feet, 33-gravity, 7/32-inch, completed 9-12-51, TD 4742.

Orange County. Algonquin Oil Company's Well 1, in 29-5s-11w, pumped 130 barrels from 4446-89 feet, 15.5-gravity, completed 9-19-51, TD 4639.

CALIFORNIA—NEW OIL PAYS

Kern County, Bacon Hills field. Superior Oil Company's Theta 54-20, in 20-28s-20e, pumped 24 barrels from Middle Miocene sand, Miocene 2185-2210 feet, 22.5-gravity, completed 9-14-51, TD, 4563.

The Texas Company's Tolco (NCT) 1, in 20-28s-20e, pumped 142 barrels from 2560-2600 feet, 19.7-gravity, completed 9-21-51, TD 5020.

Edison West field. California Exploration Company & MacMillan Petroleum Company's Porter 28-5, in 28-30s-29e, pumped 105 barrels from Sta. Margarita & Porter sand, Miocene 3919-4660 feet, 19.8-gravity, completed 9-4-51, TD 5253.

Round Mountain field. Hubbell Oil Company of Long Beach's Hubbell-Stafford 1, in 6-28s-29e, pumped 15 barrels from Pyramid Hills 14-68-1578 feet, 18-gravity, completed 9-8-51, TD 1578.

Los Angeles County, Aliso Canyon field. Carlton Beal's Mission-Adrian 2 (OWWO), in 34-3n-16w, flowed 126 barrels from 6920-7320 feet, 25.1-gravity, 5/32-inch, completed 9-3-51, TD 7580.

La Habra field. R. E. Bering's York 1, in 30-2s-10w, flowed 300 barrels from 2604-3149 feet, 21.5-gravity, 7/16-inch, completed 9-3-51, TD 3749.

Walnut field. Dewitt Langford's Vanderhoof 2, in 3-2s-10w, pumped 132 barrels from 1296-1454 feet, 18.2-gravity, completed 8-28-51, TD 2509.

CALIFORNIA—OIL FIELD EXTENSION

Kern County, Fruitvale field. Campbell, Shell & Collins' Power Farm KCL 1 (OWWO), in 29-29s-27e, 1-mile southwest extension, pumped 135 barrels from Kernco sand, Miocene 4375-4400 feet, 23.6-gravity, completed 9-13-51, TD 6015.

CALIFORNIA—GAS FIELD EXTENSIONS

Butte County, Princeton field. Honolulu Oil Corporation's Honolulu-Humble Wild Goose 2, in 18-17n-1e, ½-mile west extension, flowed 4.8-million from 3259-33-14 feet, completed 9-10-51, TD 3435.

Yolo County, Pleasant Creek field. Mohawk Petroleum Corporation's Pleasant Creek Unit 5-1, in 17-8n-1w, ¾-mile south extension, no gauge from Peters sand 2930-45 feet, completed 9-16-51, TD 3523.

COLORADO—NEW OIL FIELD

Logan County. Shell Oil Company's State 1-B, SW NE NE 16-8n-53w, flowed 38 barrels and 55 barrels water from Dakota sand, Cretaceous 4884-87 feet, completed 9-1-51, TD 5346.

ILLINOIS—NEW OIL FIELDS

Clay County, Hord, South field. Webster & Shirk's Roberts 1, NE SW SW 26-5n-6e, pumped 350 barrels from McClosky lime, Mississippian 2784-89 feet, completed 9-11-51, TD 2790.

Schnell, South field. Calvert Drilling Company's E. Gallager 1, NE NW SE 13-2n-8e, pumped 85 barrels from Rosiclare lime, Mississippian 3003-08 feet, completed 9-11-51, TD 3071.

Effingham County, Mason, North field. The Texas Company's R. Sinnickson 1, NW SW NW 10-6n-5e, pumped 53 barrels and 8 barrels water from Rosiclare lime, Mississippian 2363-2407 feet, completed 9-11-51, TD 2521.

Gallatin County, Cottonwood, North field. S. B. Griffith & Berkman's Hale 1, SW NW NE 21-7s-9e, pumped 39 barrels from Cypress sand, Mississippian 2607-18 feet, completed 9-25-51, TD 2624.

Hamilton County, Cantrell, North field. Ralph Halbert's Auten Heirs 1, NW NW SW 32-6s-5e, pumped 253 barrels from Aux Vases sand, Mississippian 3236-47 feet, completed 9-4-51, TD 3250.

Wabash County, Gards Point field. Gilliam Drilling Company's E. Miller 1, NE NW SW 25-1n-14w, pumped 312 barrels from Lower O'Hara lime, Mississippian 2838-44 feet, completed 9-25-51, TD 2844.

ILLINOIS—NEW OIL PAYS

Saline County, Long Branch field. Cullum & Lawhead's J. J. Ellis 1, SE NE NE 20-7s-6e, pumped 80 barrels from Cypress sand, Mississippian 2749-61 feet, completed 9-4-51, TD 2766.

White County, Sumpter field. Kingwood Oil Corporation's R. J. Winter 1, SW NW SE 25-4s-9e, pumped 7 barrels and 20 barrels water from Hardinsburg sand, Mississippian 2655-93 feet, completed 9-18-51, TD 3325.

ILLINOIS—OIL FIELD EXTENSIONS

Richland County, Parkersburg Consolidated field. Don Slape et al's Ivey 1, SW NE NW 15-2n-14w, ½-mile east extension, pumped 47 barrels from McClosky lime, Mississippian 3072-74 feet, completed 9-11-51, TD 3079.

White County, Epworth Consolidated field. Skiles Oil Corporation's E. A. Strophlet 1, NE SW SE 29-5s-10e, ½-mile southeast extension, pumped 46 barrels from Aux Vases sand, Mississippian 2993-99 feet, completed 9-4-51, TD 3002.

Phillipstown Consolidated field. Ashland Oil & Refining Co's & Herndon's Hanks 1, SE SE SE 14-4s-10e, ½-mile west extension, pumped 25 barrels from Bethel sand, Mississippian 2836-41 feet, completed 9-4-51, TD 2841.

Storms field. Ashland & N. V. Duncan's W. B. Hall 1, NE SW SW 36-5s-9e, ½-mile north extension, pumped 35 barrels and 20 barrels water from Rosiclare lime, Mississippian 3142-52 feet, completed 9-4-51, TD 3269.

INDIANA—NEW OIL FIELDS

Daviess County. Engelbert Michel's Vertis Ketchem 1, SE NE SW 19-5n-5w, pumped 20 barrels from Aux Vases lime, Mississippian 526-33 feet, TD 533.

Knox County. Clark and Clark & F. R. Stocker's O. W. Myers 1, in Mil Don 179-2n-9w, no gauge from McClosky lime, Mississippian 1620-23 feet, TD 1623.

Cline & Lambert Drilling Company's John Nelson 1, SW SE SE 30-2n-8w, pumped 30 barrels from Jackson sand, Mississippian, TD 1275.

Monroe County. A. Juan Drilling Company's Henry Wilkinson 1, NW SW SW 7-1n-8w, pumped 10 barrels from Jackson sand, Mississippian, TD 1160.

Posey County. Superior's Louis Breiner 1, NW NW SE 10-7s-13w, pumped 60 barrels from Waltersburg sand, Mississippian 1882-90 feet, and Tar Springs sand, Mississippian 1998-2000 feet, TD 2810.

INDIANA—NEW OIL PAYS

Dubois County, Huntingburg field. Dale Drilling Company's Lawrence Mehne 2, SW NE SE 8-3s-5w, pumped 10 barrels from Cypress sand, Mississippian 833-46 feet, TD 846.

Gibson County, Mackey, West field. Cline & Lambert's G. Conrad 1, SW NW NW 16-3s-9w, flowed 130 barrels from Upper Cypress sand, Mississippian 1589-1622 feet, TD 1861.

Posey County, Hovey, West field. C. L. McMahon Incorporated's Gray Estate 1, NW NW SE 35-7s-15w, pumped 105 barrels from Lower Renault lime, Mississippian 2678-2704 feet, TD 2900.

Posey County, Welborn Consolidated field. Tuley & Carter's Claude Wilson 1, SE SW SW 17-6s-14w, pumped 15 barrels from Tar Springs sand, Mississippian 2139-47 feet, TD 2903.

INDIANA—NEW GAS PAY

Gibson County, Mackey, West field. Cline & Lambert's Norman Annis 1, SE SE SE 8-3s-9w, flowed 10-million from Upper Cypress sand, Mississippian 1618-26 feet, TD 1875.

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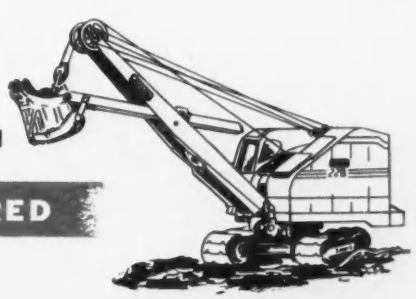

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KANSAS—NEW OIL FIELDS

Barton County, Fort Zarah, North field. Alpine Oil & Refining Company's McIlrath 1, NE NE NW 19-19s-12w, flowed 346 barrels from Lansing-KC lime, Pennsylvanian 3208-14 feet, TD 3410.

Butler County. Eckland Drilling Company's Neiman 1, NW NW SE 9-24s-3e, pumped 25 barrels from Mississippi lime, Mississippian 2758-60 feet, TD 2760.

Decatur County. The Texas Company's Keenan 1, NW NW SE 25-4s-27w, pumped 162 barrels and 100 barrels water from Lansing-KC lime, Pennsylvanian 3478-82 feet, TD 3925.

Graham County, Law, South field. Harry Gore's Frank Law 1, NW NW SW 2-10s-23w, pumped 77 barrels from Marmaton lime, Mississippian 4126-42 feet, TD 4270.

Smith-Denning, West field. Deep Rock Oil Corporation & Barnett Drilling Company's Beecher 1, NW NW NE 6-10s-21w, pumped 195 barrels from Arbuckle lime, Ordovician 3880-82 feet, TD 3882.

Rice County, Sterling field. Flynn Oil Company's Mayer 1, NW SE SE 4-22s-8w, pumped 10 barrels and 20 barrels water from Mississippi lime, Mississippian 3365-95 feet, TD 3395.

Seward County, Kneeland field. Columbian Fuel Corporation & United Producing Company's Kneeland 1, C NE NE 23-34s-31w, pumped 12 barrels and 12 barrels water from Marmaton lime, Mississippian 5302-56 feet, TD 6300.

Stafford County. Anderson Prichard Oil Corporation's Cochlin 1, SW SW SW 19-22s-11w, pumped 210 barrels from Arbuckle lime, Ordovician 3658-63 feet, TD 3663.

Wendelburg field. Carl Todd Drilling Company's Wendelburg 1, SE SW NE 19-23s-11w, pumped 371 barrels from Arbuckle lime, Ordovician 3729-32 feet, TD 3733.

KANSAS—NEW OIL PAYS

Stafford County, Smallwood field. Westgate-Greenland Drilling Company's Wetig 2, SE NW SE 2-22s-14w, pumped 25 barrels from Arbuckle lime, Ordovician 3756-67 feet, TD 3773.

Sumner County, Guelph field. Herndon Drilling Company's Gurley 2, NW SW NE 6-35s-1e, potentialed 2039 from Simpson lime, Ordovician 3836-60 feet, TD 3860.

KENTUCKY—NEW OIL FIELDS

Henderson County, Baskett field. Joe Reznik et al's George Farley 1, C SE 15-Q-25, pumped 188 barrels from O'Hara lime, Mississippian 2319-24 feet, TD 2324.

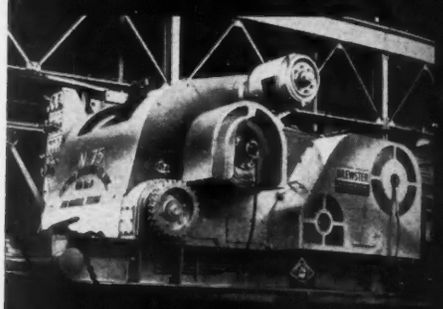
Henderson, South field. George S. Engle's W. T. Posey Estate 1, in 14-P-23, pumped 18 barrels from McClosky lime, Mississippian 2594-99 feet, TD 2600.

Unnamed field. Nash Redwine & J. Salee's S. A. Alexander 1, in 10-P-24, pumped 32 barrels and 5 barrels water from Aux Vases lime, Mississippian 2242-49 feet, TD 2280.

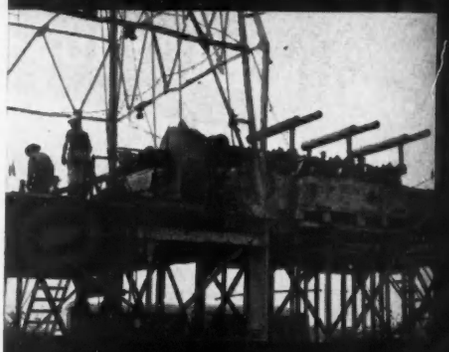
NORTH LOUISIANA—NEW OIL FIELDS

Catahoula Parish. Hunt Oil Company's et al's Louisiana Delta Hardware Lumber Company Incorporated et al 44, in 7-4n-5e, pumped 91 barrels from Wilcox sand, Eocene 5930-45 feet, completed 9-2-51, TD 6050.

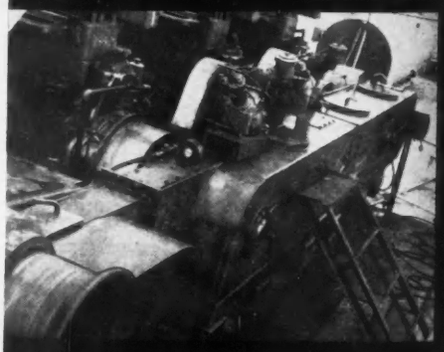
Webster Parish, Bellevue, East field. Skelly Oil Company's E. L. Stewart 1,



Drum and transmission assembly of Brewster N-75 Draw-works.



Rigging-up Cactus Drilling Company's N-75 on West Texas location.



Brewster's new N-75 compound.

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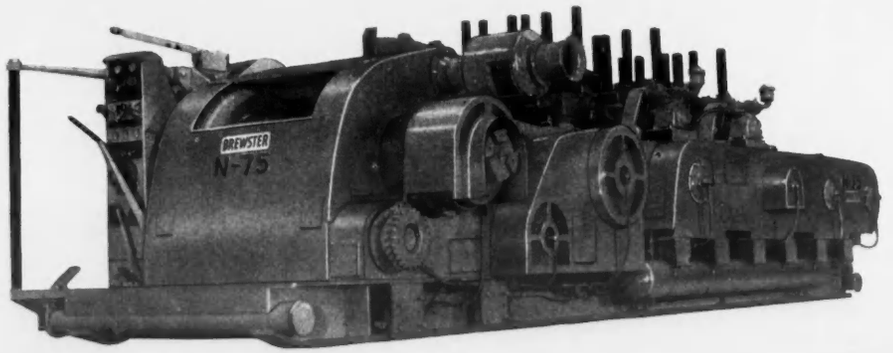

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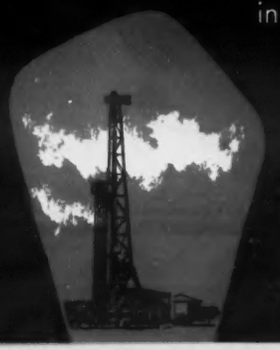

BREWSTER COMPANY, INC. Shreveport, Louisiana

BREWSTER DRILLING EQUIPMENT

in 19-19n-10w, flowed 251 barrels from Pettit lime, Lower Cretaceous 3978-4010 feet, 31.1-gravity, 3/16-inch, completed 9-10-51, TD 7780.

NORTH LOUISIANA—OIL FIELD EXTENSION

Madison Parish, Delhi field. Murphy's & Sun Oil Company's J. K. Mahony 1-C, in 30-17n-10e, 1½-mile south extension, flowed 10 barrels from 3687-91 feet, 40.4-gravity, 5/32-inch, completed 9-12-51, TD 3910.

NORTH LOUISIANA—NEW DISTILLATE FIELD

Caddo Parish, "Sentell" field. Butler Johnson Service Corporation's J. M. Sentell 1, in 35-19n-14w, flowed 15 barrels and 16-million from Bodcaw sand, Jurassic 8324-46 feet, completed 9-14-51, TD 8350.

SOUTH LOUISIANA OIL FIELD EXTENSION

Jefferson Parish, Westwego field. Stanolind's Missouri Pacific Railroad 1, in 29-13s-23e, west extension, flowed 134 barrels from 9076-90 feet, 35.5-gravity, 1/8-inch, completed 9-15-51, TD 10,353.

SOUTH LOUISIANA—NEW GAS FIELDS

Terrebonne Parish. Shell's State Lease 1799-1, Block 23, flowed 1.4-million from 2657-62 feet, ¼-inch, completed 9-2-51, TD 14,000.

MICHIGAN—NEW OIL FIELDS

Allegan County. Ford Oil Company's Slotman 1, SE SW SE 20-3n-14w, Heath Township, pumped 2 barrels from Traverse lime, Mississippian 1401-04 feet, TD 1404.

Barry County. Universal Drilling Company's Fry 1, SW NE NE 17-1n-8w, Johnstown Township, pumped 5 barrels from Traverse lime, Mississippian 1857-68 feet, TD 1899.

MISSISSIPPI—NEW OIL FIELD

Franklin County, White Apple, South field. Dave Gammill & Lyke Cashion Company's D. F. Anderson 1, in 3-5n-1e, pumped & flowed 92 barrels and 10 barrels water from Wilcox sand, Eocene 6265-66 feet, 38.5-gravity, completed 9-18-51, TD 7000.

MISSISSIPPI—NEW OIL PAYS

Adams County, Carthage Point field. Vaughey & Vaughey's Adams County Board of Supervisors 2, (OWWO) in 3-6n-4w, flowed 110 barrels from Wilcox sand, Eocene 5972-74 feet, 39.8-gravity, 1/8-inch, completed 9-19-51, TD 10,252.

Franklin County, White Apple, South field. Sun's J. D. Seab 1, in 45-6n-1e, pumped & flowed 96 barrels from Lower Wilcox sand, Eocene 6423-26 feet, 37.9-gravity, ¼-inch, completed 9-6-51, TD 7004.

MISSISSIPPI—OIL FIELD EXTENSION

Adams County, Pine Ridge field. Barnett Serio's F. M. McGehee 1, in 34-8n-2w, ½-mile northeast extension, pumped 102 barrels from Artman sand, Eocene 5616-20 feet, 40.5-gravity, ½-inch, completed 9-26-51, TD 5670.

NEBRASKA—NEW OIL FIELD

Cheyenne County. Brown Drilling Company's Scheeler 1, NE NE SE 11-16n-48-w, pumped 85 barrels from 1st Dakota sand, Cretaceous 4150-51 feet, completed 9-20-51, TD 4301.

NEW MEXICO—NEW OIL FIELDS

Lea County. Amerada Petroleum Corporation's State ECA-1, in 14-12s-32e, flowed 550 barrels from Devonian lime, Devonian 11,260-270 feet, 43.3-gravity, ½-inch, completed 8-31-51, TD 11,314.

Lea County. The Texas Company's State AR-1, in 2-11s-37e, flowed 319 barrels from Devonian lime, Devonian 11,500-580 feet, 43.1-gravity, 3/8-inch, completed 8-27-51, TD 11,580.

NEW MEXICO—NEW GAS FIELDS

San Juan County. Southern Union Producing Company's Vanderslice 1, NE SW NW 19-32n-10w, flowed 2.2-million from Mesaverde sand, Upper Cretaceous 5066-5375 feet, completed 9-4-51, TD 5375.

Stanolind's Unit 4, C SE NW 24-26n-10w, flowed 0.3-million from Dakota sand, Cretaceous 6630-6800 feet, completed 8-30-51, TD 7072.

OKLAHOMA—NEW OIL FIELDS

Grant County. Cummings-McIntyre & Mid-Continent Petroleum Corporation's G. Combs 1, SE SE NE 6-25n-5w, flowed 480 barrels from Marshall & Wilcox sands, Ordovician 5959-78 feet, 47-gravity, 1/8-inch, TD 5982.

Logan County. Davon Oil Corporation et al's Derr 1, NW NE NE 16-17n-3w, flowed 175 barrels from Layton sand, Pennsylvanian 4646-84 feet, ⅜-inch, TD 4700.

Okfuskee County, Boley field. Wisner Oil Corporation's J. F. Darby et al 1, NE SE NE 21-12n-8e, pumped 19 barrels and 24 barrels water from Cromwell

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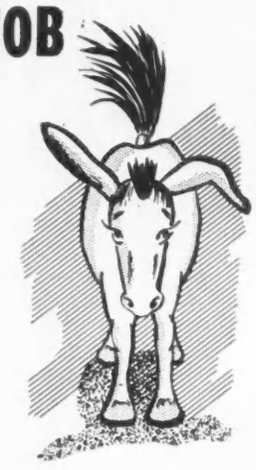

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sand, Pennsylvanian 3724-27 feet, TD 3788.

Osage County, Ross Day, East field. Sunray's Oil Corporation's Osage 1, NE NE NE 10-24n-4e, pumped 17 barrels and 60 barrels water from Mississippi chat, Mississippian 3374-84 feet, TD 3908.

Pawnee County, Terlton, Southeast field. Big Four Petroleum Company's Hattie Sinclair 1, SW NW SW 34-20n-8e, flowed 11 barrels and 3 barrels water from Bartlesville sand, Pennsylvanian 2495-2505 feet, 38-gravity, TD 2505.

Un-named field. D & L Oil Corporation's School Land 1-B (OWDD), SE SW NE 16-21n-6e, pumped 23 barrels and 40 barrels water from Prue sand, Pennsylvanian 2603-12 feet, 36-gravity, TD 2663.

Pottawatomie County, Victory Hill, Southwest field. Wood Oil Company's Brant 1, SE NE SW 18-10n-5e, pumped 25 barrels from Wilcox sand, Ordovician 4771-80 feet, TD 4780.

OKLAHOMA—NEW OIL PAYS

Lincoln County, Sparks, East field. Delaney Drilling Company's State 1, NW SW SW 16-13n-5e, flowed 164 barrels from Hunton lime, Mississippian 4757-82 feet, 49.5-gravity, 5/32-inch, TD 4782.

Stephens County, Velma field. Sinclair Oil & Gas Company's Avis Armstrong 1, NW SW NW 2-2s-4w, pumped 144 barrels from Humphrey sand, Pennsylvanian 6270-6447 feet, TD 7770.

OKLAHOMA—OIL FIELD EXTENSIONS

Beckham County, Elk City field. Howell & Howell & Walter Duncan's Johnson-Reisner 1, C NE NE 11-10n-22w, ½-mile northwest extension, flowed 189 barrels and 14 barrels water from Hoxbar conglomerate, Pennsylvanian 9946-60 feet, 40-gravity, ¼-inch, TD 10,685.

Noble County, Ceres field. Johnson-Sampson Construction Company's Wentz 1, NW NW SW 33-24n-1e, ½-mile east extension, flowed 120 barrels from Bartlesville sand, Pennsylvanian 4266-4320 feet, 43-gravity, 11/64-inch, TD 4324.

Otoe City field. D & L Oil Company's Loula 1, NW NW NW 16-22n-1e, ½-mile northwest extension, flowed 312 barrels from Layton sand, Pennsylvanian 3405-10 feet, ½-inch, TD 3410.

Washita County, Sentinel, West field. Gulf Oil Corporation's A. B. Walker 1, C NE SW 9-8n-20w, 1-mile east extension, flowed 128 barrels from Granite Wash, Pennsylvanian 5565-5645 feet, 32.9-gravity, 7/16-inch, TD 5645.

OKLAHOMA—NEW DISTILLATE FIELD

Garfield County. Sterling Oil Co., of Oklahoma's L. Brunken 1, SW SE NE 29-23n-4w, flowed 18 barrels and 1.5-million from Mississippi lime, Mississippian 5514-56 feet, 51-gravity, ¼-inch, TD 6132.

OKLAHOMA—NEW GAS FIELD

Lincoln County. Mid-Continent's Mable M. Rueb 1, SW SW NE 23-15n-5e, flowed 1.9-million from Prue sand, Pennsylvanian 3325-42 feet, open, TD 4294.

TEXAS DISTRICT 1—NEW OIL FIELD

Frio County. Sid Katz' Simmons 2, BS&F Survey, pumped 6 barrels from 880-88 feet, 16.0-gravity, completed 8-18-51, TD 888.

TEXAS DISTRICT 1—NEW OIL PAY

Atascosa County, Imogene, South field. Martin, Shelly & Thomas' J. T. Davis 1, Dr. C. F. Simmons Ranch Subdivision, pumped 62 barrels from 1809-14 feet, 19.8-gravity, completed 9-12-51 TD 1814.

TEXAS DISTRICT 1—OIL FIELD EXTENSION

Caldwell County, Larremore field. Southern Producing Company's Emil Willms 1, C. Crenshaw Survey, 3/4-mile southeast extension, pumped 18 barrels from Edwards lime, Lower Crestaceous 1327-31 feet, 30-gravity, completed 8-22-51, TD 1364.

TEXAS DISTRICT 1—NEW GAS PAY

McMullen County, Baker field. W. Earl Rowe & P. R. Rutherford's Earl M. Baker 2, E½ Seale & Morris Survey, flowed 8-million from 1824-36 feet, open, completed 8-14-51, TD 3450.

TEXAS DISTRICT 2—NEW OIL PAYS

DeWitt County, Helen Gohlke-Fordtran field. Shell's Helen Gohlke 4, H. C. Kitchen Survey, flowed 157 barrels from Yegua sand, Eocene 5354-58 feet, 3/16-inch, completed 9-22-51, TD 8202.

Live Oak County, Karon, North field. Stanolind's Maude M. Weed 1, R. D. Brown Survey, flowed 76 barrels from Luling sand, Eocene 7301-03 feet, 38-gravity, 7/64-inch, completed 8-30-51, TD 7304.

TEXAS DISTRICT 2—NEW DISTILLATE FIELD

Karnes County. Horrigan & Fohs Oil Company's Mary Pargmann et al 1, Victor Blanco Survey, flowed 30 barrels and 30-million from Luling sand, Eocene

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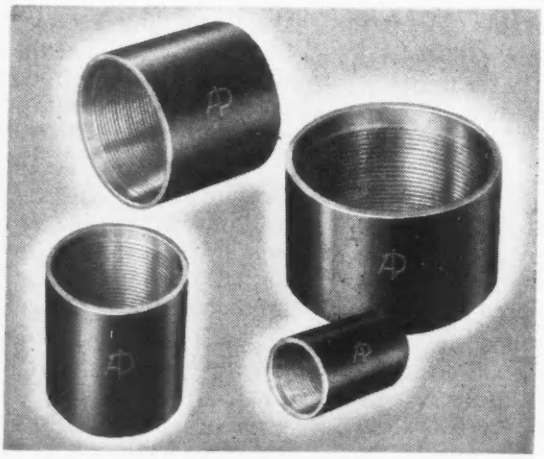

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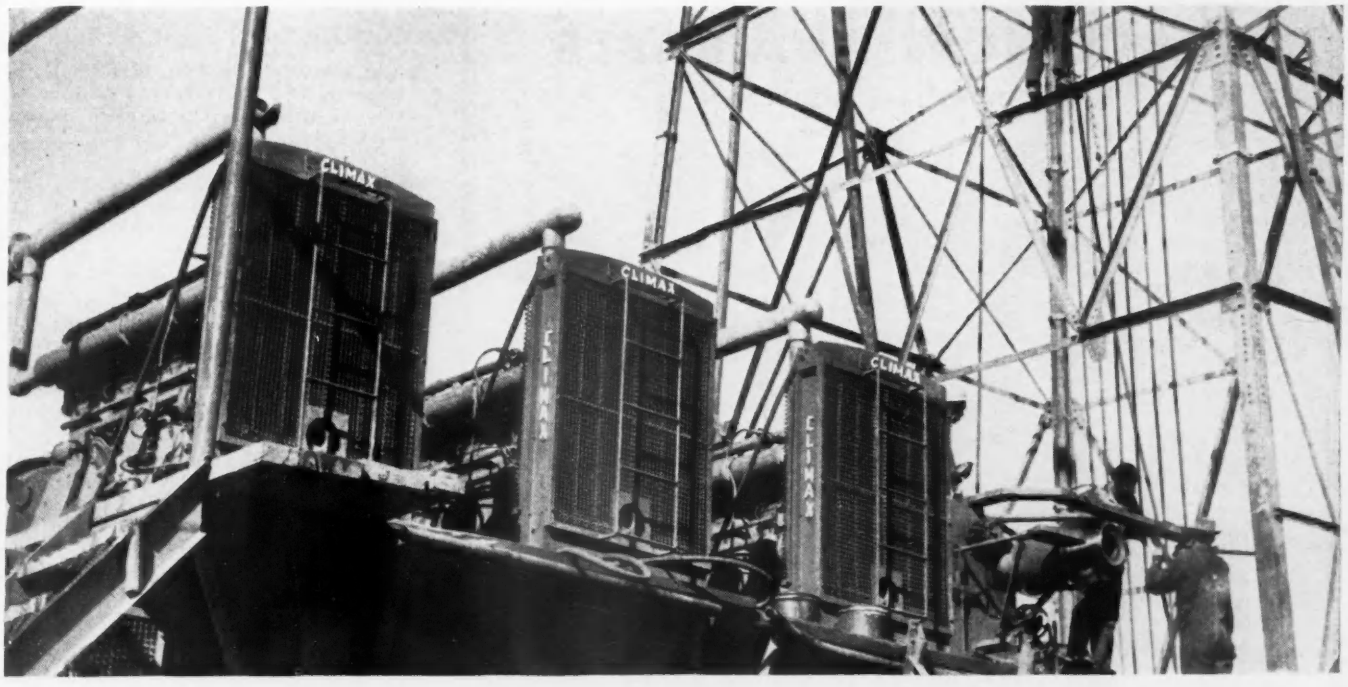

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7158-78 feet, open, completed 8-29-51, TD 7400.

TEXAS DISTRICT 2— NEW DISTILLATE PAY

Live Oak County, Chapa field. Atlantic Refining Company's Sanger Heirs 1, GC&SFRR Company Survey, flowed 240 barrels and 3.8-million from 8658-70 feet, 53-gravity, 3/16-inch, completed 9-22-51, TD 9298.

TEXAS DISTRICT 2— DISTILLATE FIELD EXTENSION

Bee County, Sliva field. Bridwell Oil Company's J. G. Rountree 2, H&GN Survey, 3/4-mile northeast extension, flowed 15-million from 4392-98 feet, open, completed 9-1-51, TD 4510.

TEXAS DISTRICT 2—NEW GAS PAY

Bee County, Caesar, South field. R. S. Randerson's Slick 1, J. M. Thurston Survey, flowed 13-million from Pettus lime, Lower Cretaceous 3201-13 feet, open, completed 9-1-51, TD 3500.

TEXAS DISTRICT 2— GAS FIELD EXTENSIONS

Bee County, Heard Ranch field. Heep Oil Corporation's Claude E. Heard 1-B, Jeremiah Tool Survey, 1½-mile southwest extension, flowed 25-million from 4274-80 feet, open, completed 9-1-51, TD 4955.

Calhoun County, Long Mott, South field. Quintana Petroleum Corporation's Hynes-Spiller et al 1, Matthew Dockery Survey, 5/8-mile northeast extension, flowed 4.6-million from Frio sand, Oligocene 7398-7416 feet, TD 7787.

Goliad County, Gottschalt field. Callery & Hurt, Incorporated's C. C. Ludicke Estate 1, A. Berry Survey, ½-mile northeast extension, flowed 5.5-million from 7660-70 feet, 5/16-inch, TD 7925.

TEXAS DISTRICT 3— NEW OIL FIELDS

Fort Bend County. The Texas Company's H. B. McCrary et al 1, James Knight & G. W. White League, flowed 42 barrels from 7470-80 feet, 40.1-gravity, 5/32-inch, completed 9-11-51, TD 7830.

Jefferson County, Big Hill, North field. McCarthy Oil & Gas Corporation's Mrs. Dora Gill et al 1-B, Section 165, T&NO Survey, flowed 144 barrels from 8445-52 feet, 33.5-gravity, 7/64-inch, completed 9-3-51, TD 9714.

Newton County. Christensen & Matthews' V. J. Morgan et al 1, J. Champion Survey, flowed 50 barrels from 7548-52 feet, 40.2-gravity, 9/64-inch, completed 9-26-51, TD 8016.

TEXAS DISTRICT 3—NEW OIL PAYS

Austin County, New Ulm field. Sinclair's Loake Unit 1 (OWWO), J. Tylee Survey, flowed 162 barrels from Wilcox sand, Eocene 9271-81 feet, 37.8-gravity, 3/16-inch, TD 10,022.

Fort Bend County, Fulshear field. Union Producing Company's Feeney 1, Stephen Habermaker Survey, flowed 43 barrels from Yegua sand, Eocene 7307-08 feet, 39.6-gravity, 7/64-inch, completed 9-14-51, TD 7524.

Hardin County, Nelson field. American Republics Corporation et al's Mary J. Cunningham et al 1, O. C. Nelson League, flowed 122 barrels from 7078-82 feet, 40.9-gravity, 7/64-inch, completed 9-11-51, TD 7093.

Jefferson County, Fannett field. Gulf's Junker-Spencer et al 21-A, William H. Smith Survey, flowed 182 barrels from 7366-75 feet, 33.6-gravity, 9/64-inch, completed 9-9-51, TD 9883.

Montgomery County, Willis field. P. L. D. Well Service Company's Tony R. Snow et al 3, William Weir Survey, flowed 96 barrels from 3732-34 feet, 28-gravity, 5/32-inch, completed 9-6-51, TD 3746.

Newton County, Campton field. Houston Oil Co. of Texas & American Republics' Earl C. Hankamer et al 5-B, HT&B RR Survey, flowed 42 barrels from 7219-21 feet, 38.3-gravity, 7/64-inch, completed 9-12-51, TD 7227.

TEXAS DISTRICT 3—NEW DISTILLATE FIELD

Matagorda County. Magnolia Petroleum Company's Ethel Cornelius 1, J. C. Peyton Survey, flowed 192 barrels and 10 million from 11,375-385 feet, 46-gravity, completed 9-29-51, TD 14,485.

TEXAS DISTRICT 3—NEW GAS FIELDS

Brazoria County. Brazos Oil & Gas Company's Ducroz et al 1, Calvin Sumrells Survey, no gauge from 3068-80 feet, completed 9-10-51, TD 7804.

Unnamed field. Champlin Refining Company's State 1-A, Bastrop Bay, flowed 60-million from Miocene sand, Miocene 5770-88 feet, TD 7256.

Fort Bend County. Harold Link's Cantrell et al 1, Sam Stone Survey, H&TC Survey, no gauge from 4624-36 feet, completed 8-7-51, TD 4750.

Liberty County. General Crude Oil Company's Esperson 5-C, William Bloodgood Survey, no gauge from Yegua sand,

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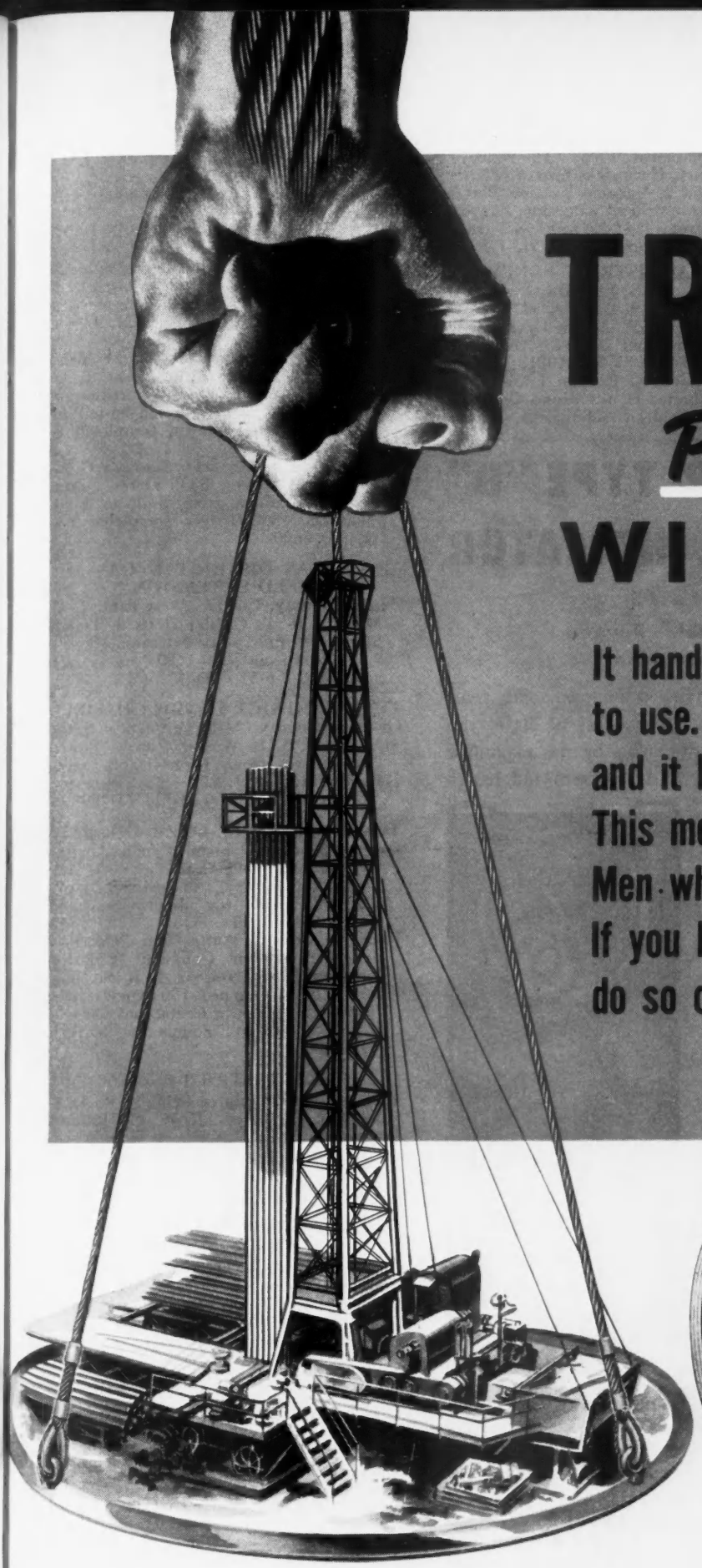

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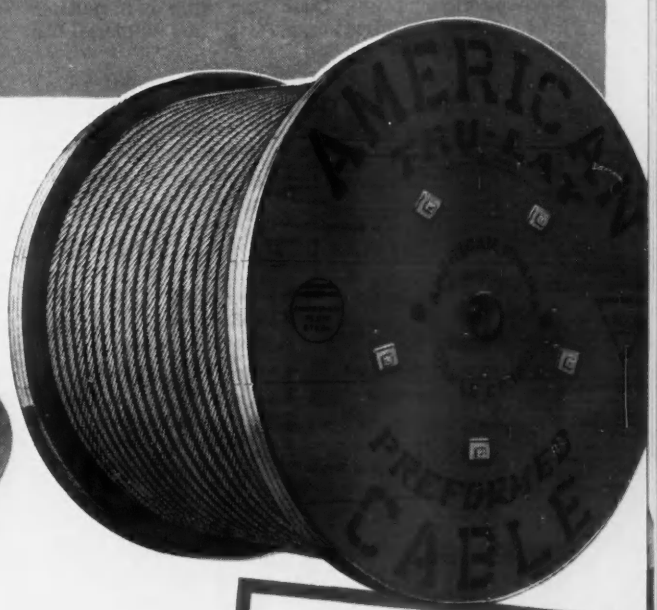

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Eocene 8990-94, completed 9-27-51, TD 10,459.

TEXAS DISTRICT 4—NEW OIL PAYS

Aransas County, Blackjack field. Western Natural Gas Company's St. Charles Ranch Company 16, Block 5-A, Aransas CSL Survey, flowed 240 barrels from Frio sand, Oligocene 8288-98 feet, 48.7-gravity, ¼-inch, completed 9-21-51, TD 8991.

Nueces County, London field. Seaboard Oil Company of Delaware's Chapman 17, Section 38, Laureles Farm Tract, flowed 99 barrels from 9665-9715 feet, 58.0-gravity, completed 9-28-51, TD 9950.

TEXAS DISTRICT 4—OIL FIELD EXTENSIONS

San Patricio County, Portilla field. Superior's Minnie S. Welder 32, C. J. Francisco & E. Portilla Survey, 1½-miles south extension, flowed 112 barrels from 7124-30 feet, 41.8-gravity, 5/32-inch, completed 9-7-51, TD 7230.

Starr County, Hardwicke field. Sinclair's J. A. Garcia 2, Ygnacio Trevion Porcion, 1¼ miles northeast extension, flowed 20 barrels from 4121-27 feet, 48.3-gravity, 5/32-inch, completed 9-27-51, TD 6110.

TEXAS DISTRICT 4—NEW GAS FIELDS

Jim Hogg County. Sun's A. C. Jones 47, Agua Nueva de Abajo Grant, flowed 5.7-million from 4910-81 feet, open, completed 9-51-51, TD 4981.

Jim Wells County. Paisano Trading Company, Limited et al's Bruno Goldapp 1, Lot 4, Waldron Subdivision, Sherman Survey, flowed 37.5-million from 3388-3400 feet, open, completed 9-7-51, TD 6395.

Nueces County. Renwar Oil Corporation & Phillips Petroleum Company's J. C. Blacknall 1, O. R. Warner Survey, no gauge from 6057-60 feet, TD 6500.

TEXAS DISTRICT 4—NEW GAS PAYS

Aransas County, Blackjack field. Western Natural's St. Charles Ranch Company 14, Isaac Dowers Survey, flowed 3.3-million from Frio sand, Oligocene 11,-460-490 feet, open, completed 9-9-51, TD 11,615.

Nueces County, Riverside-Wright field. Lockhart Oil Company of Texas' E. C. Wilson 7, W. W. Wright Partition of Jose Vincente Survey, flowed 96-million from 4617-29 feet, open, completed 8-28-51, TD 5285.

Starr County, Flores field. Sunray's G. G. Zamora 1, Section 883, Flores Grant, flowed 42-million from Sullivan sand, Oligocene 4366-79 feet, completed 9-5-51, TD 6600.

TEXAS DISTRICT 4—GAS FIELD EXTENSION

Zapata County, Cuellar, West field. J. C. McCabe et al's Cuellar Heirs 3, TCRR Survey, ½-mile west extension, flowed 0.3-million from 1089-1125 feet, ¼-inch completed 8-6-51, TD 1125.

TEXAS DISTRICT 5—NEW OIL FIELD

Grayson County. Mid-Continent's Sussie Martin 1, J. B. Walker Survey, flowed 252 barrels from Pennsylvania sand, Pennsylvanian 6912-93 feet, 34-gravity, ¼-inch, completed 9-14-51, TD 6993.

TEXAS DISTRICT 5—NEW OIL PAYS

Grayson County, Unnamed field. George W. Humphrey's C. H. Barnes 1-A, William Allen Survey, pumped 77 barrels from 3500-28 feet, 37-gravity, completed 9-8-51, TD 3528.

Kaufman County, Walter Fair field. Producers Investment Company & Ralph Spence's F. E. Lumpkin 1, B. S. Newman Survey, pumped 139 barrels from Rodessa lime, Lower Cretaceous 6364-72 feet, 32.3-gravity, completed 9-21-51, TD 6880.

TEXAS DISTRICT 6—NEW

Wood County, Deupree field. F. R. Jackson's E. A. Byers 1, R. G. Ramsey Survey, pumped 136 barrels from Woodbine sand, Upper Cretaceous 5738-48 feet, 16.2-gravity, completed 9-22-51, TD 6483.

TEXAS DISTRIST 6—NEW DISTILLATE FIELD

Anderson County. The Texas Company's C. W. Hanks et al 1, Isaac Lindsey Survey, flowed 170 barrels and 1.7-million from James lime, Lower Cretaceous 10,094-104 feet, 56.3-gravity, 9/64-inch, completed 9-14-51, TD 10,758.

TEXAS DISTRICT 6—DISTILLATE FIELD EXTENSION

Cherokee County, Jacksonville, North field. L. W. Dennis & Eugene J. Hunter's C. L. Newburn 1, F. J. Anthony Survey, 1-mile northeast extension, flowed 10 barrels and 8.8-million from Woodbine sand, Upper Cretaceous 4350-53 feet, 56.8-gravity, completed 9-14-51, TD 4371.

TEXAS DISTRICT 6—NEW GAS FIELD

Harrison County. Arkansas Fuel Oil Company's Henrietta M. Riley 1, D. C. Moore Survey, flowed 8.5-million from Pettit lime, Lower Cretaceous 6150-65 feet, completed 9-27-51, TD 6700.

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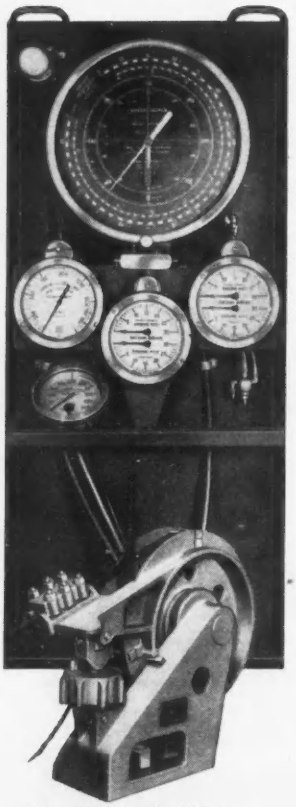

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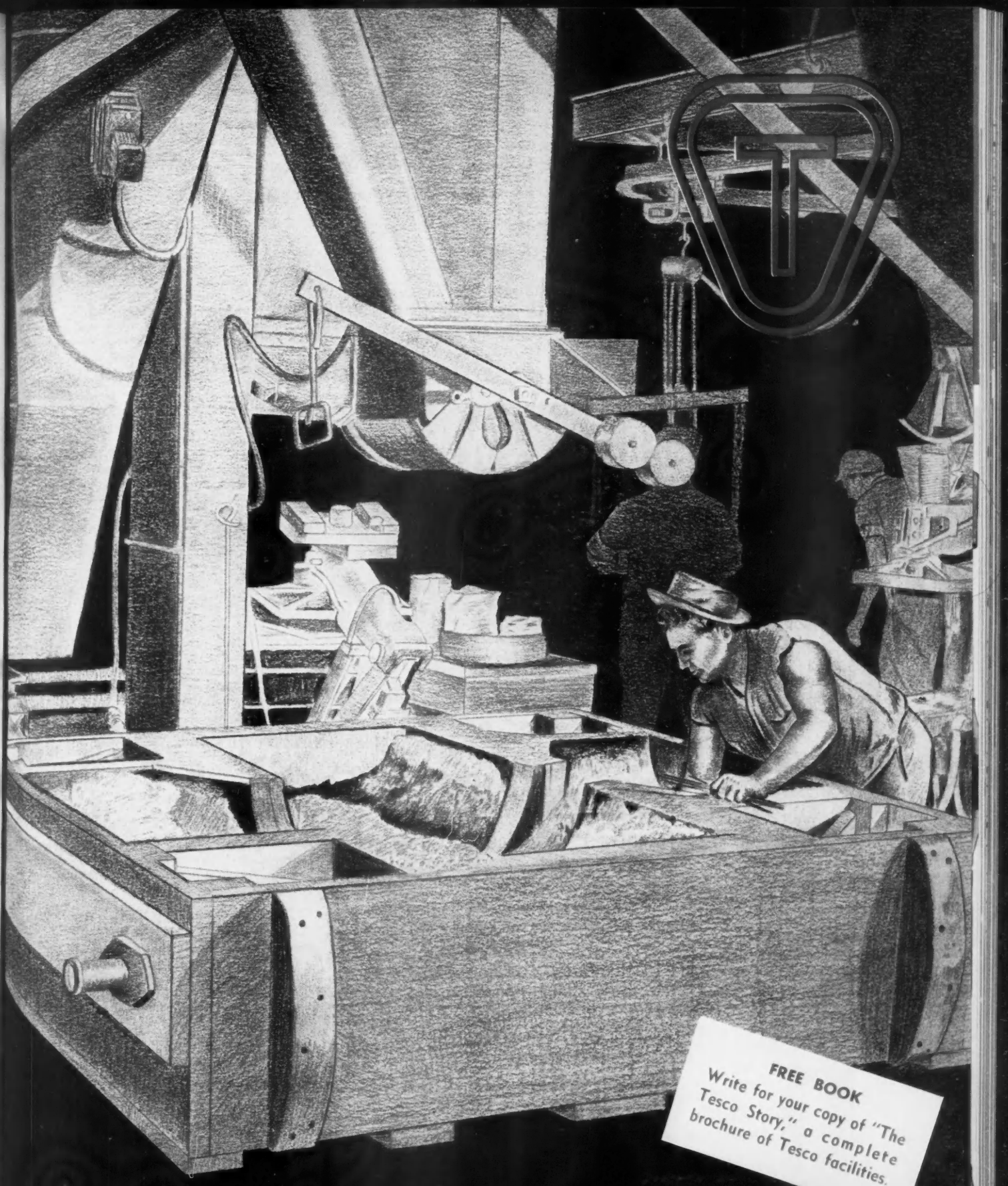

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TEXAS DISTRICT 7—NEW OIL FIELDS

Reagan County. Atlantic's Calvin H. Sugg 1, Section 134, Block 2, T&P Survey, flowed 103 barrels from Wolfcamp lime, Permian 8095-8120 feet, 45.1-gravity, ¼-inch, completed 9-11-51, TD 10,285.

Unnamed field. Lloyd H. Smith & James H. Snowden's O. L. Greer 1, Section 43, Block A, L&SV Survey, pumped 41 barrels and 21 barrels water from Spraberry sand, Permian 6099-6130 feet, 39-gravity, completed 9-1-51, TD 6130.

Runnels County. Miami Operating Company, Incorporated's McKissick 1, Section 16, Block 515, A. Losoya Survey, flowed 23 barrels from Gardner sand, Pennsylvanian 3765-75 feet, 42.6-gravity, 7/32-inch, completed 9-10-51, TD 3775.

Runnels County. Vincent & Welch, Incorporated et al's Elwood E. Brown Jr. 1, S. F. Austin & S. M. Williams Survey, flowed 52 barrels from Jennings sand, Pennsylvanian 3754-61 feet, 41-gravity, ⅝-inch, completed 9-21-51, TD 4258.

TEXAS DISTRICT 7-C—NEW OIL PAY

Crockett County, World field. Continental Oil Company's L. P. Powell 1-E, Section 62, Block BB, TCRR Survey, flowed 288 barrels from Strawn sand, Pennsylvanian 8088-8172 feet, 40.7-gravity, 45/64-inch, completed 9-22-51, TD 8288.

TEXAS DISTRICT 7-C—OIL FIELD EXTENSIONS

Reagan County, Weddell-Spraberry field. Stanolind's Sadie J. Weddell 1, Section 4, Block G, C&M Survey, 1-mile south extension, flowed 252 barrels from Spraberry sand, Permian 7078-7124 feet, 40-gravity, 7/16-inch, completed 9-5-51, TD 7124.

Upton County, Pembrook field. Anderson Prichard's B. R. Greathouse 1, Section 13, Block D, EL&RR Survey, 1½-mile east extension, flowed 270 barrels from Spraberry sand, Permian 6840-6910 feet, 38.6-gravity, ½-inch, completed 9-13-51, TD 6910.

TEXAS DISTRICT 8—NEW OIL FIELDS

Andrews County. Magnolia's Tom Peay 1, Section 6, League 314, Gaines CSL Survey, flowed 375 barrels from Wolfcamp lime, Permian 9227-9300 feet, 39.2-gravity, ½-inch, completed 9-1-51, TD 14,085.

Borden County. Vickers Petroleum Company, Incorporated's Myrtle McKnight 1, Section 367, Block 97, H&TC Survey, pumped 11 barrels and 25 barrels water from Canyon Reef lime, Pennsylvanian 7732-44 feet, 38-gravity, completed 9-2-51, TD 7760.

Dawson County. El Tee Oil Company's Briley et al 1-96, Section 96, Block M, ELRR Survey, flowed 734 barrels from Canyon Reef lime, Pennsylvanian 8575-90 feet, 40.1-gravity, 25/32-inch, completed 9-20-51, TD 8640.

Gaines County. Union's T. C. Weltmer 2, Section 16, Block A-12, PSL Survey, flowed 99 barrels from Lower Clearfork sand, Permian 7108-42 feet, 46.9-gravity, 31/64-inch, completed 9-19-51, TD 7144.

Midland County. Sinclair's June Tippett 3, Section 17, Block 40, T-4-S, T&P Survey, flowed 786 barrels from Ellenburger lime, Ordovician 12,960-13,090 feet, 51.5-gravity, ½-inch, completed 9-19-51, TD 13,133.

Midland County. The Texas Company's Clarence Scharbauer 3-D, Section 18, Block 39, T-2-S, T&P Survey, flowed 384 barrels from Bend lime, Pennsylvanian 10,658-708 feet, 43.3-gravity, 9/32-inch, completed 9-27-51, TD 10,722.

TEXAS DISTRICT 8—NEW OIL PAY

Kent County, Cogdell-Strawn field. Chapman & McFarlin's D. M. Cogdell 49, Section 33, Block 4, H&GN Survey, flowed 265 barrels from Strawn sand, Pennsylvanian 7323-30 feet, 34.5-gravity, ½-inch, completed 9-17-51, TD 8092.

TEXAS DISTRICT 8—OIL FIELD EXTENSION

Pecos County, Abell, Southeast field. Murphy Corporation's R. D. Blaydes 1 ,Section 19, Block 2, H&TC Survey, 1½-mile southeast extension, pumped 102 barrels from Ellenburger lime, Ordovician 5837-58 feet, 42-gravity, completed 9-9-51, TD 5982.

WYOMING—NEW OIL FIELD

Big Horn County. General Petroleum's Mable West 1 (OWDD), C SE NW 20-50n-92w, flowed 480 barrels from Phosphoria lime, Pennsylvanian 7211-7337 feet, 42.3-gravity, ¾-inch, completed 9-18-51, TD 8080.

WYOMING—NEW OIL PAYS

Fremont County, Riverton field. Atlantic's Tribal 3, C SW NE 25-1s-4e, flowed 100 barrels from Phosphoria lime, Pennsylvanian 11,586-623 feet, 51-gravity, 9/32-inch, completed 9-2-51, TD 13,335.

Hot Springs County, Gebo field. Continental's Unit 32, NW NW SE 23-44n-95w, flowed 26 barrels from Tensleep sand, Pennsylvanian 4855-5146 feet, 23.4-gravity, ½-inch, completed 9-7-51, TD 6198.

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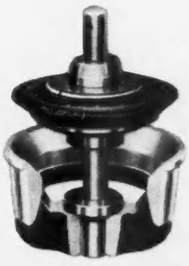

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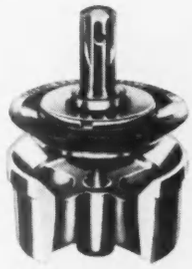

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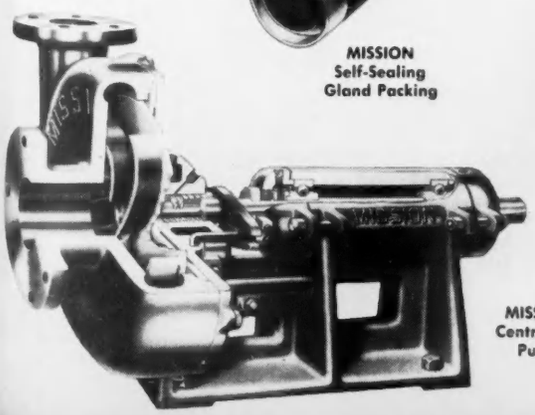

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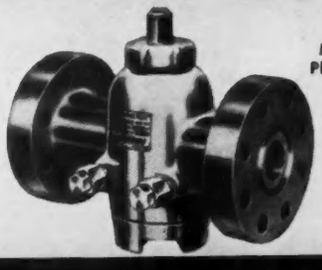
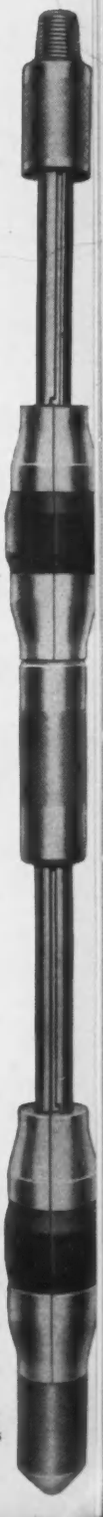
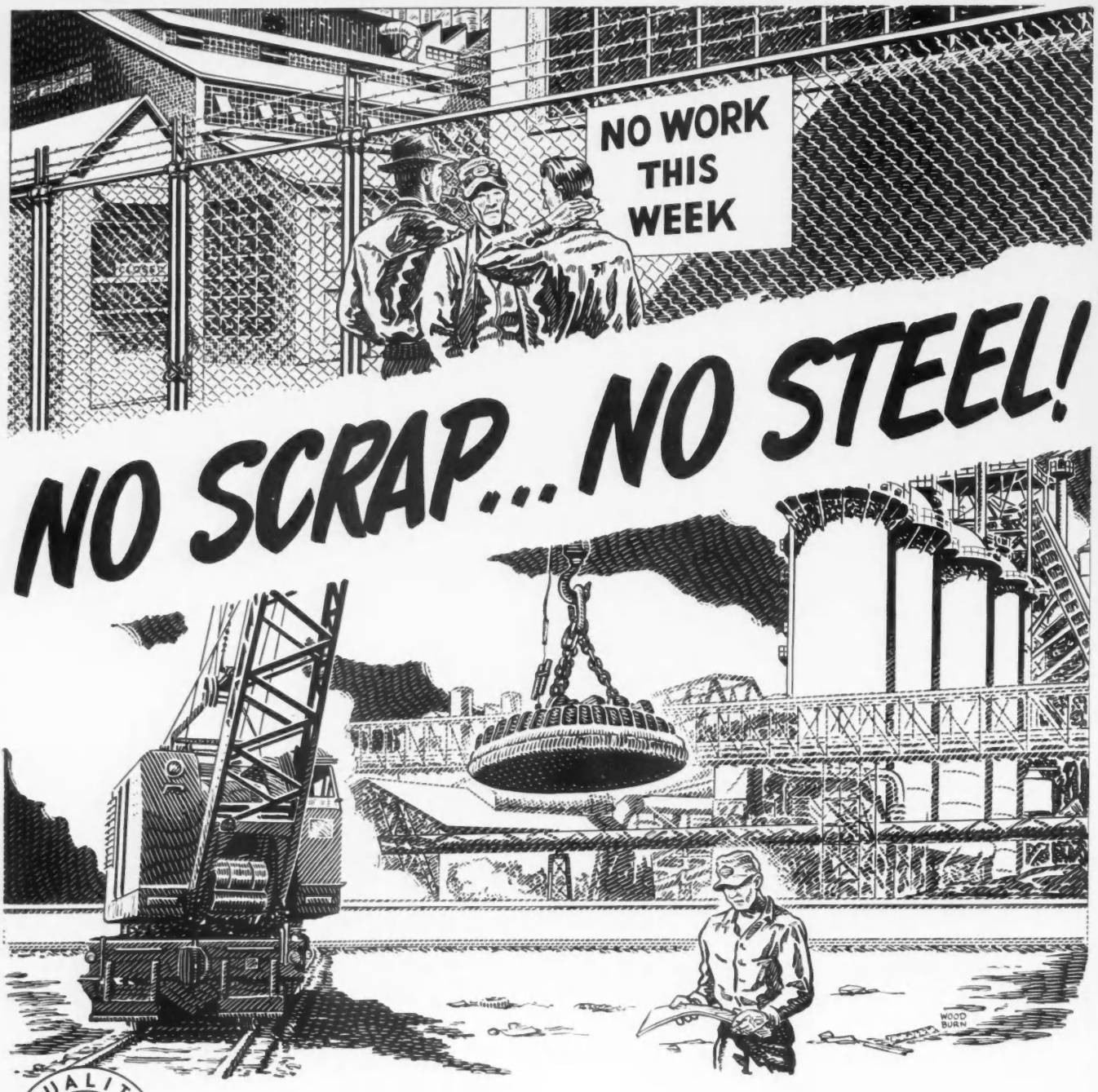


MISSION Plug Valve



MISSION Valveless Swab



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Rowan's Barge Rig 13

By JOHN A. BOATMAN

Division Maintenance Supervisor, Rowan Drilling Company, Inc.

THE FABRICATION of efficient and flexible drilling barges is an exacting science which allows little tolerance for error. Described in this article is one of the more modern, powerful and completely unitized diesel-electric drilling barges in the industry. A complete pictorial description illustrates the compact and sturdy construction of Rowan Drilling Barge 13.

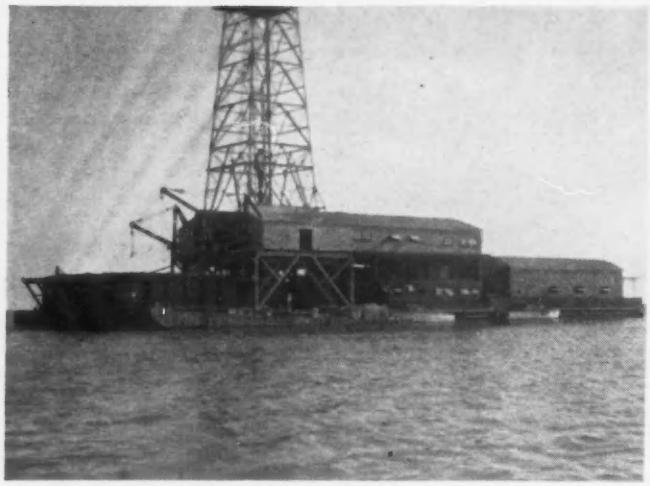
ONE of the drilling industry's most modern barge-mounted drilling rigs was placed in operation last July by Rowan Drilling Company, Incorporated, Fort Worth. Upon completion of the outfitting of the barges, the rig was towed to location in Timbalier Bay, Terrebonne Parish, Louisiana, where it began operations on the Louisiana State Lease PP-1, for the Gulf Oil Corporation. It presently is drilling the sixth well in that vicinity for the same company.

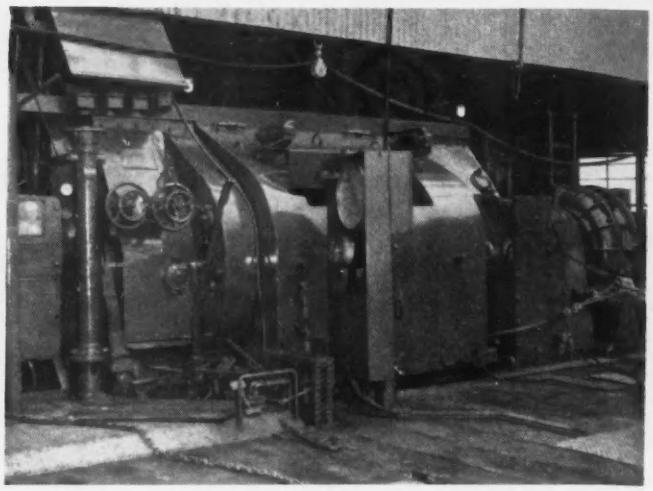
Of conventional two-barge construction, the submersible hulls are 164 feet long, 54 feet wide and 12 feet deep, with a 10-foot slot. The power barge is 100 feet long, 34 feet wide and 12 feet deep. Both barges are raked at either end for towing ease in either direction. They are separated by two pinned spreaders made from drill pipe. Connecting the barges is a 36-inch wide catwalk hinged to the power barge and raised and lowered by hydraulic cylinders. Power cables between the barges are raised and lowered as one unit by a hand-operated winch. Water, air and fuel lines between the barges are connected by the customary unions and swings.

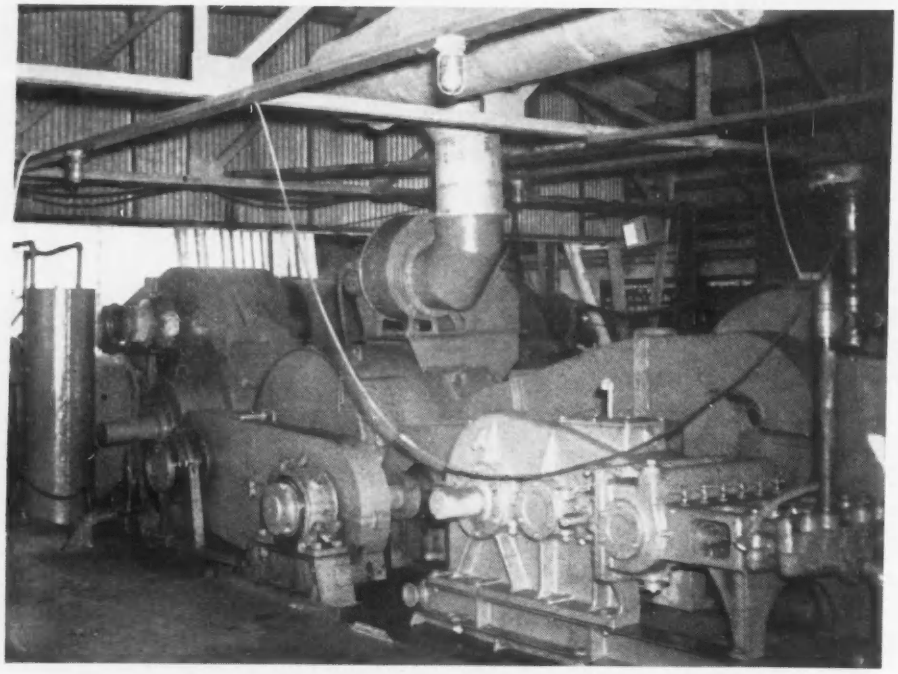
In addition to the derrick, substructure and main drilling machinery, the drill barge also contains the reserve mud pits, the active mud pits, the pump room, dry mud storage, mud laboratory, drillers' office, drilling superintendent's office and quarters, visitor's quarters, crew's change room, and the galley. The power barge contains the main and auxiliary engines and generators, the main switch board, raw water circulating pumps and motors for engine cooling, fresh water and lubricating oil heat exchangers for the engines, air compressors and air receivers for engine starting and general rig use, fuel oil transfer pumps and motors, dirty lubricating oil tank, lubricating oil centrifuge, reclaimed lubricating oil tank, new lubricating oil tank, fresh water storage, fuel oil storage, washdown pump and enginemen's change room.

A thorough description of the machinery and its features will be covered later. At this point, we wish to list the main items which are generally found on any drilling rig of comparable size and similar construction.

The derrick is 154 x 30 feet, rated at 800,000 pounds and with a wind load capacity of 135 miles per hour. Provision has been made for changing the derrick to 187 x 38 feet by adding extra sections to the base of the present derrick. The substructure is 15 feet high and is void of vertical columns in the area under the drill floor. Weight on the drill floor is carried from the floor beams through angular beams to the vertical columns outside the working area. This allows a maximum of working area on the main







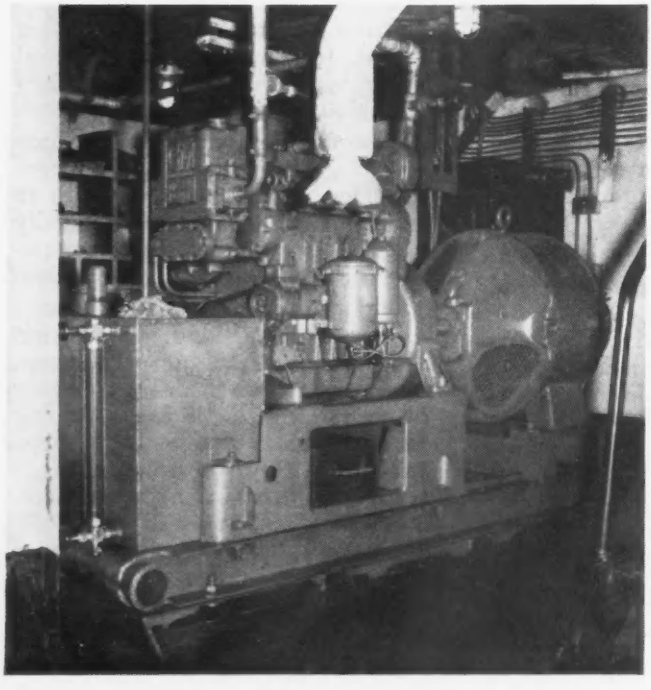
TOP LEFT: The Rowan barge on its first location in Timbalier Bay, Terrebonne Parish, Louisiana.

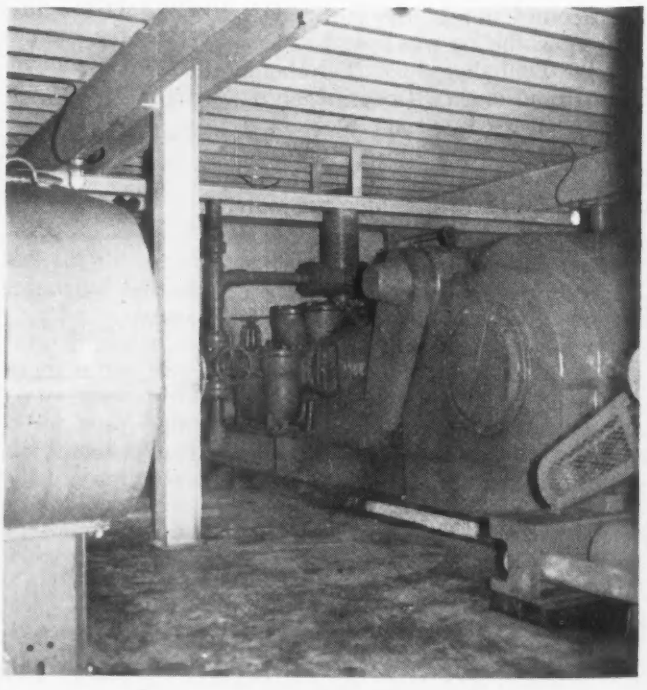
TOP RIGHT: Drawworks with explosion-proof control panel on headboard.

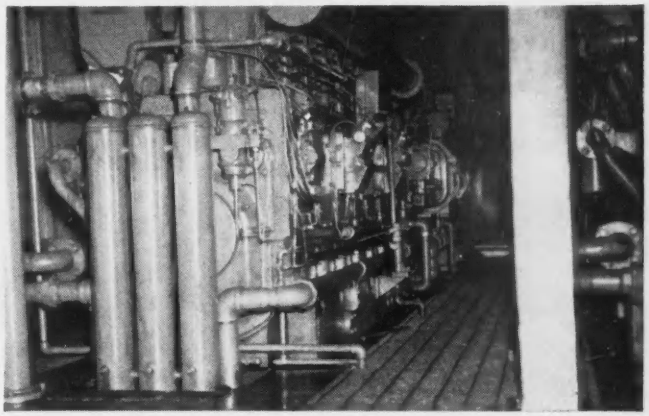
LEFT: Rear view of drawworks, showing motor, blower, feed control and core reel.

LOWER LEFT: Auxiliary generator powered by diesel engine.

LOWER RIGHT: Portion of the pump room, showing complete safety features afforded by enclosed belt guards.







LEFT: Partial view of the engine room, showing two of the eight-cylinder, 675-horsepower supercharged diesel engines and generator sets. Note engine instrument panels and storage room for spare parts.
RIGHT: Each engine is equipped with lubricating oil filters and all water and oil piping lead to heat exchangers installed in a lower compartment.

deck and contributes greatly to the efficient and safe handling of the blowout preventer equipment. Each blowout preventer is racked on its individual skid. The skid together with its preventer is pulled across portable bridge beams which span the slot, the preventer is lifted, the skid and bridge beams are removed, and the preventer set in place on the well head.

The drawworks is equipped with a hydraulically operated 42-inch diameter friction-type high clutch. An 1¼-inch diameter drilling line is used on the 30⅝-inch diameter x 41-inch long plain drum.

The drawworks motor is 800-horsepower, 395 volts direct current, 1620 amperes, 600 revolutions per minute, capable of absorbing 150 percent overload on hoisting cycle. Fresh cooling air for this motor is brought in through a duct which reaches to the end of the barge farthest from the well. The air is furnished by a blower direct mounted on a 3-horsepower direct current explosion-proof motor. Rate of penetration of the drill bit is controlled by a 100-ton hydraulic feed control, chain connected to a counter shaft which is mounted between the feed control and the drawworks motor. The core reel also is chain driven off the counter shaft. A 40-inch double hydromatic brake completes the main hoisting machinery.

The rotary is direct coupled to a 300 horsepower direct current motor. Cooling air for the rotary motor is furnished by a blower, direct mounted on a 3-horsepower direct current explosion-proof motor.

There are three main slush pumps. Pump No. 1 is an 8½ x 16-inch, rated 700 hydraulic horsepower at 65 rpm. It is chain-driven by an 800-horsepower direct current motor, which is self-cooled by a built-in fan on the motor. A feature of chain guard construction is the installation of hinged ports which permit the inspection of chain lubrication at a glance. Wing nuts allow rapid opening of the glass port for inspection and cleaning of the oil nozzle. The glass is protected by a hinged cover.

Pump No. 2 is a 7¾ x 18-inch, rated 385 hydraulic horsepower at 55 rpm. It is chain-driven by a 500 hp direct current motor. Cooling air for this motor is furnished by a blower direct mounted on a 3 hp direct current explosion-proof motor.

Safety Stressed

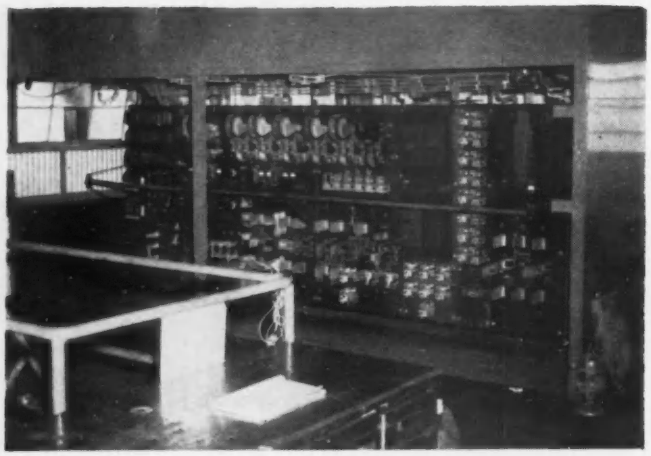
Pump No. 3 is the same as Pump No. 2. It is chain-driven by a 400 hp direct current motor. Cooling air for this motor is furnished by a blower direct mounted on a 3 hp direct current explosion-proof motor. As with the drawworks and rotary motor, cooling air for the pump motors is brought in through ducts which reach to the end of the drill barge farthest from the well. Every effort has been made to make all equipment in hazardous areas explosion proof. Safety and efficiency have been stressed throughout the construction of the rig. A safety feature in pump operation is the use of indicator lights and switches on the pump motor field excitation circuits. When a pump is in operation, the field excitation circuit is closed and a red indicator light burns, warning the crew members not to attempt any repairs or adjustments. When pump repairs are necessary, a switch in the pump motor field excitation circuit is opened, during which time a green light burns. This open circuit precludes any accidental running of the pump from the driller's control station. These switches and indicator lights are positioned in the pump room for ease in stopping the pumps during an accident or other emergency.

The active mud pits are adjacent to the pump room, providing a loaded suction for the pumps. Mud is kept agitated by a mechanical mixer in the active pits. Dry mud and chemicals are brought aboard by conveyor powered by a 2 hp direct current explosion-proof motor.

Main power is furnished by four 8-cylinder, 4-cycle, 9-inch bore x 10½-inch stroke, supercharged diesel engines, each rated 675 horsepower at 900 rpm. Supercharging is provided by turbochargers driven by the engine exhaust gases. Engines 1, 2 and 4 are direct coupled to 400 kilowatt direct current generators. Flexible couplings connect the prime movers and generators. Each main generator has a belt driven 35 kw exciter for auxiliary power and field excitation. A 4 kw pilot exciter is direct coupled to each 35 kw exciter. Engine No. 3 is direct connected, through a flexible coupling to a 300 kw direct current generator. Mounted above this generator and belt driven is a 135 kw direct current generator. A 35 kw exciter and 4 kw pilot exciter completes power unit No. 3. The main electric control panel is 18 feet long.

The time required for the rigging up of the main power cables between the two barges is held to a minimum by the use of clamp-on connectors instead of bolted lugs. Main power cables from the generators and exciters to the panel board are run downward and under the deck plating, leaving the overhead open for the travel of an overhead crane. Engine exhaust is carried out the end of the power barge, which allows the crane to travel the full interior length of the power barge. The chain hoist is capable of lifting and moving the largest component part of any of the units. The heaviest piece would be a bare engine frame.

Auxiliary equipment is in a compartment directly under the main engines and generators. Raw water for



LEFT: Master switchboard and control panel with hand rail and rubber deck matting to safeguard personnel.
RIGHT: Partial view of auxiliary equipment showing water pumps, duplex strainers, and heat exchangers.

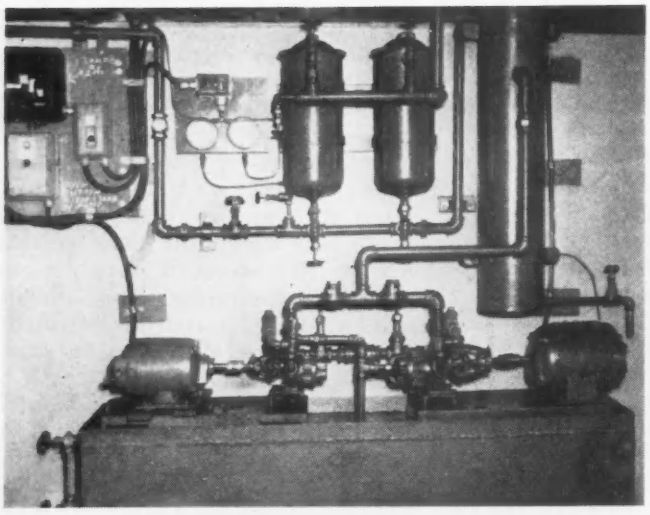
engine cooling is brought in through two sea chests, one on either side of the power barge. The sea chests are covered by a strainer and are fitted with air to blast away accumulated debris. A ten-inch header connects the two sea chests so either chest can be used while the other is being cleaned. Flanged to this header are two six-inch duplex strainers, one side of which can be cleaned while the other side is in operation. Connected to each strainer are two centrifugal pumps. Each pump is direct connected to a 3 hp splash-proof motor.

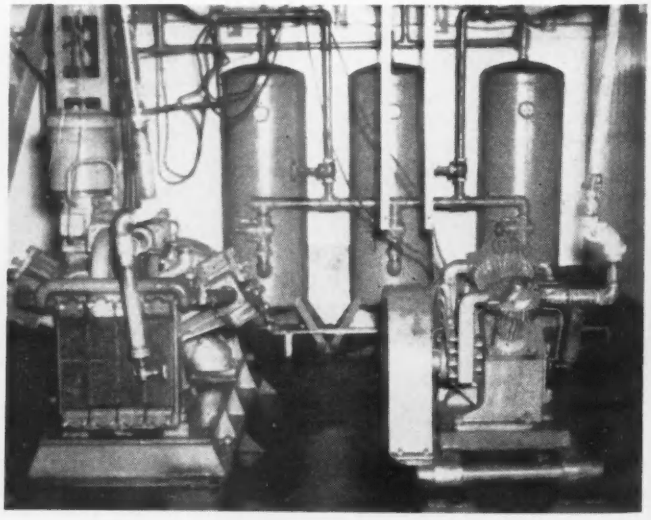
All four of the raw water circulating pumps discharge into a common manifold from which manifold the raw water enters the engine fresh water heat exchangers and lubricating oil heat exchangers. This arrangement allows all four of the main engines to be cooled by any combination of from one to four of the circulating pumps. During cool weather and while the engines are operating under a light load, one pump is usually sufficient. To date, it has not been necessary to operate more than two pumps at one time, thus providing a 100 percent margin in efficiency in the event of pump or motor failure.

When operations on a new job are begun, auxiliary power is furnished by a 30 kw direct current generator, direct connected to a two-cycle diesel engine. This power is used to operate the air compressors for the development of starting air for the main diesel engines. It is also used to provide exciter current, if necessary, during down time on any of the main power units.

Two air compressors are provided; one, 4½ inches and 3¾ x 4 inches, is direct connected to a 15 hp direct current motor. The other compressor, 6 inches and 3½ x 5 inches, is belt driven by a 15 hp direct current motor. Air is received by and stored in three tanks tested to 600 pounds per square inch. Additional air, to operate power slips and blowout preventer pumps, is stored in two tanks near the shale shakers on the drill barge.

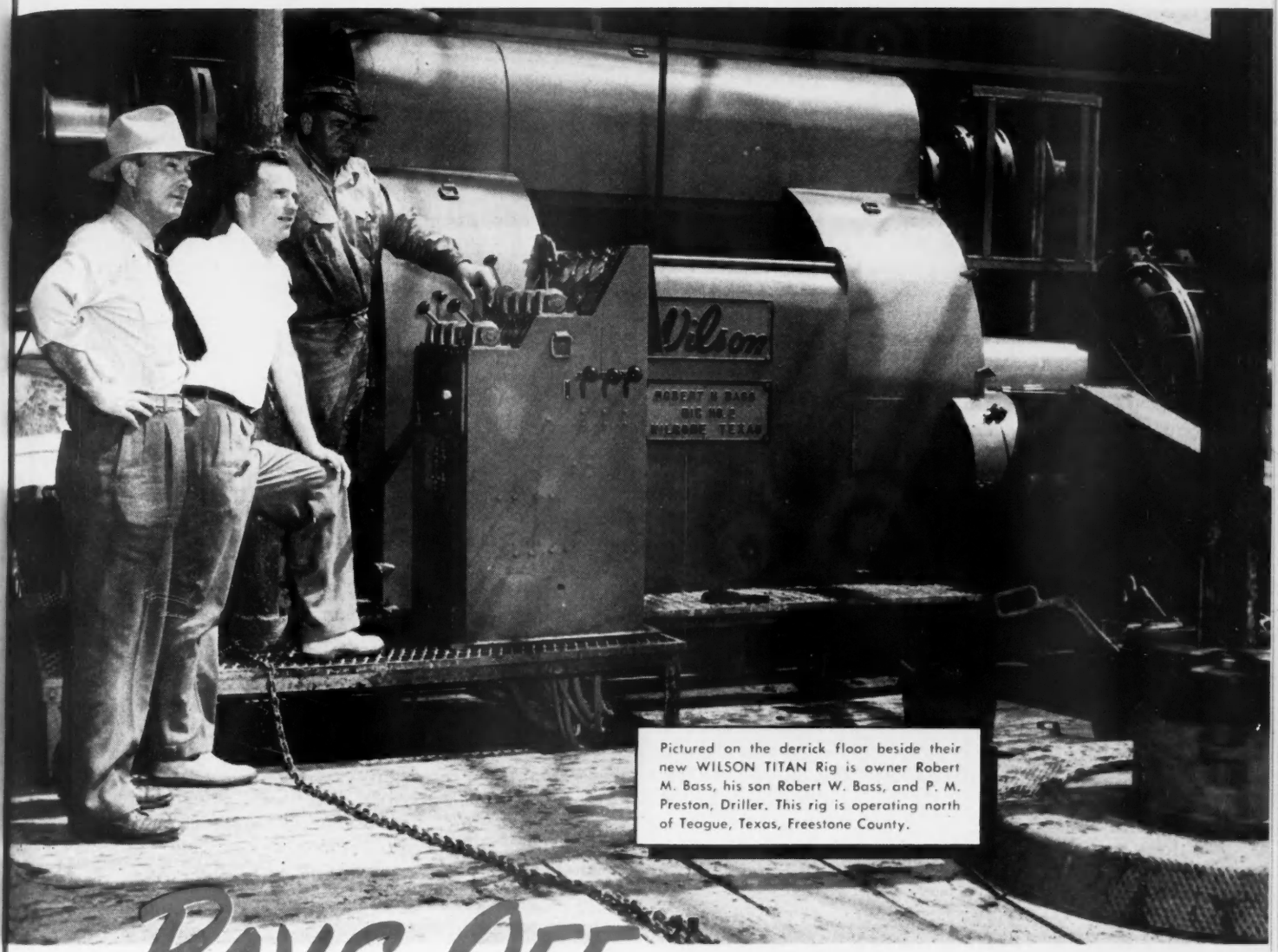
Fuel oil is furnished under low pressure to the diesel engines by two gear pumps, each direct driven by a 1 hp direct current splash-proof motor. Only one pump is in service at one time. Should the fuel pump or its motor fail, or should the fuel pressure drop below a certain reading, a pressure operated switch will bring into operation a series of magnetic contactors, starting the idle motor and pump. Fuel is delivered from the pumps into a settling tank where any water is drained off when cleaning fuel is withdrawn. From the settling tank fuel is forced through two filters. Pressure gauges on the inlet and outlet of the filters indicate





LEFT: Additional equipment in the auxiliary compartment, including fuel transfer pumps, fuel filters, and automatic controls. Note sediment tank positioned between the pumps and the filters, and the drip storage tank under the pumps.
RIGHT: A view of the air compressor plant and receiver tanks stationed in the auxiliary compartment.

"Wilson ADVANCED ENGINEERING...



Pictured on the derrick floor beside their new WILSON TITAN Rig is owner Robert M. Bass, his son Robert W. Bass, and P. M. Preston, Driller. This rig is operating north of Teague, Texas, Freestone County.

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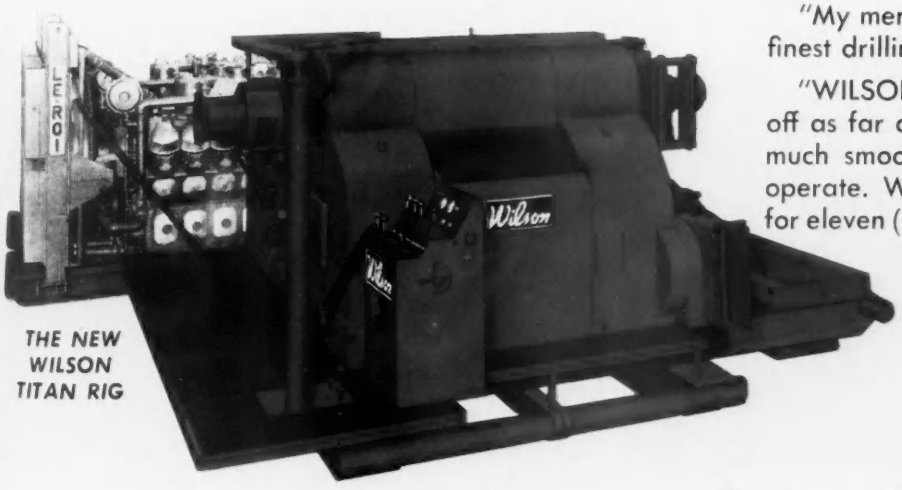

THE NEW WILSON TITAN RIG

"My men say our new WILSON TITAN Rig is the finest drilling rig they have ever operated.

"WILSON ADVANCED ENGINEERING has paid off as far as we are concerned because this rig is much smoother running and more economical to operate. We have been operating WILSON Rigs for eleven (11) years and we feel they can't be beat.

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the proper time for a change of filter elements.

Used lubricating oil from the engines is drained by gravity from the crankcases into a used oil tank. In the event that the oil was contaminated by water or dirt, it is cleaned by a centrifuge. Close control is maintained over the engine lubricating oil by periodic testing. An oil testing kit is used to check viscosity, acid, water, dirt and asphalt content. To date, it has not been necessary to change engine oil for any reason other than fuel dilution. If the fuel dilution gradually reaches the point which calls for discarding the engine oil, the fuel-cut oil is drained into a clean oil tank and is used as make-up oil for the engines. Should a broken fuel line suddenly dilute the oil far beyond the safe point, this oil is used on slush pump rods.

Each of the main diesel engines has a warning device consisting of an air-loaded trip valve set under each connecting rod bearing cap in the engine crankcase. The trip valve is adjusted to within .006-inch of the connecting rod bearing cap. Should a connecting rod bearing shell out in excess of the .006-inch setting, the connecting rod bearing cap will trip the valve, releasing the air from the system and causing a solenoid valve to stop the supply of fuel to that engine. A warning signal will call the operator's attention to the trouble. Thus, costly crankshaft damage can be avoided. Gutters built in the engine skids conduct any leakage to a collection sump under the main engines. A sump pump delivers this waste oil to drums whereby it can be transported to land for burning.

Bug fans are used to dispel insects and for crew comfort. They are direct connected to 2 hp direct current explosion-proof motors. The pump room and the engine room each have two 28-inch exhaust fans direct mounted on 3 hp direct current explosion-proof motors.

The drilling line reel is mounted on a shaft in a weather-protected compartment directly under one of the pipe racks. When it becomes feasible to cut the drilling line off, new line is played off the reel which is chain-operated by an air motor.

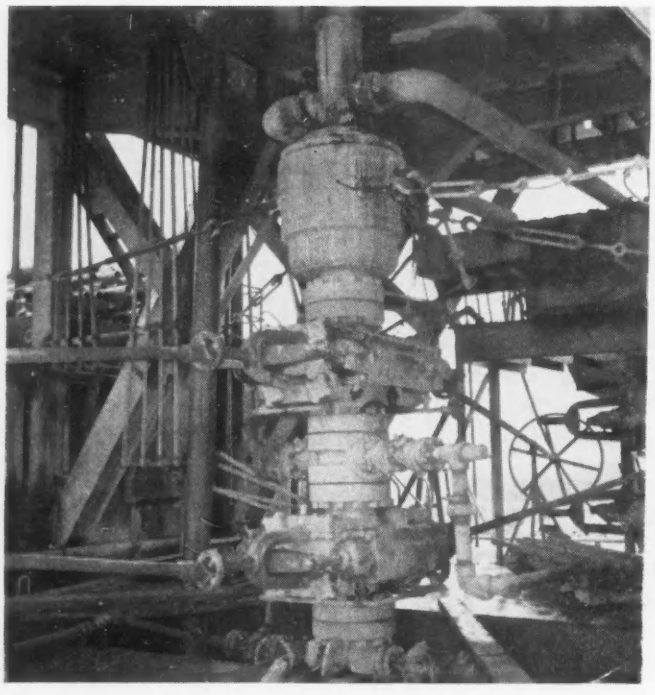
Ample Drains

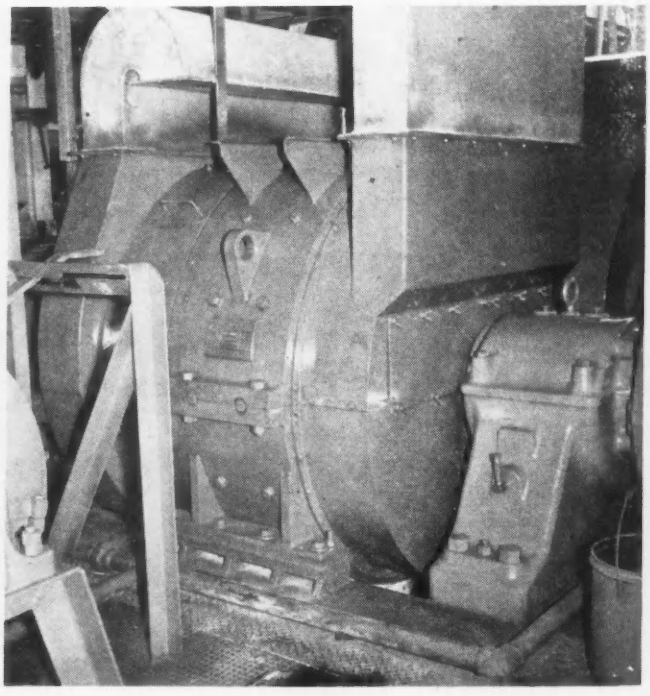
Ample drains are situated at various places on the main deck of the drill barge. All drains lead to the slot, which is enclosed by a removable solid gate, whereby any accumulated oil may be pumped to a burning pit or to a waste barge. Coaming along the edges of the drill barge prevents waste oil from being washed over the side, conforming to the laws which govern the conservation of fish and oysters.

Upon the completion of a well, the water ballast in both barges is removed by hydraulic jets operated by any one of the three main slush pumps. In addition to jets, the power barge ballast is also removed by four 12-inch turbine pumps. Each of these turbine pumps is operated by a vertical 7½ hp direct current motor.

Mindful of the need for a high rate of availability for each piece of machinery on the rig, the company maintains a full-time crew of maintenance supervisors, both mechanical and electrical, who are charged with the responsibility of keeping the rig at peak operating efficiency. Crew meetings are held at regular intervals, at which time safety and efficient operating methods are stressed. Through these meetings personnel hazards are reduced and peril to the invested capital of the oil company and the drilling contractor is held to a minimum.

The drilling barge rig under discussion was the third to be placed in service by Rowan. Early this year a single barge, diesel-electric rig was completed and is finishing its first well at this writing. It was christened the "M. G. Rowe" in honor of Rowan vice president Gilbert Rowe, who is in charge of company operations. A fifth diesel-electric barge rig was launched in May and was christened the "L. J. Hartmangruber" in honor of Rowan division superintendent for the Gulf Coast, Louis Hartmangruber. A sixth drill barge is under contract and is scheduled to be completed early this fall. It will be named the "Clifford Yancey" in honor of Rowan division drilling superintendent C. W. Yancey, Gulf Coast division. The barges "Rowe," "Hartmangruber" and "Yancey" are of similar design—200 feet long, 54 feet wide, 12 feet deep and with an 8-foot slot.





LEFT: The specially-designed substructure does not include vertical beam s, allowing for comparative ease in changing and maneuvering preventers. Adequate well protection is assured by the three blowout preventers.

RIGHT: Close-up of the 800-horsepower drawworks motor equipped with ducts which direct fresh air from the far end of the drilling barge.

Controlled Tong Torque Increases Drill Collar Service

A NEW TOOL permits exacting control of torque values in the tonging of tool joints. Field use has shown that with proper application, washouts and distorted connections will become relatively non-existant. By utilizing the tool in conjunction with rig operation for a one-year period, Magnolia Petroleum Company estimates that in the West Texas division an $18,450 savings was realized from elimination of many fishing jobs resulting from drill collar failure.

EXACTING control of tong torque in drill collar makeup will assure longer service life and reduce the possibility of twistoffs on bottom. West Texas drilling technique, which includes the employment of tandem drill-collar strings, must allow for compensation of dangerous stress and "wobble" developed within the tool joints. Merely tightening the tool joint invites twistoffs, washouts, and actual parting of loose joints.

Realizing the importance of properly engaged collar joints, F. W. Schall, petroleum engineer for Magnolia Petroleum Company in West Texas, studied the use of a tong torque indicator. Before installing the torque indicator, Schall compiled data indicating that operations the previous year resulted in 712 hours invested in fishing for drill collars. After the indicator had been in service one year, it was found that fishing time was reduced to 220 hours, or a reduction of 77 percent. From the standpoint of economics, proper utilization of the torque indicator saved approximately $18,450, based on a rig charge of $900 per day, during the year the indicator was in service.

Reasons for Collar Failures

Near perfection in manufacturing permits little tolerance for the failure of properly maintained drill collars. Factors contributing to drill collar failure include excessive rotary speeds, overtonging, corrosion fatigue, and loose joints. An intelligent discussion of all these factors is impossible at this time. Since our primary concern is the effect of torque factors, this presentation will be limited to overtonging and loose joints.

Figure 1 illustrates the result of over-tonging—a pin stretched 3/16 inch.

This serious distortion may be seen near the base of the profile gauge where the stretch is so extensive that a lead indicator cannot be employed to advantage. The development of this condition is not restricted to the pin component of a tool joint. Though difficult to illustrate, the attached box is damaged to a comparable degree. The presence of stretched pins and elongated collars introduce a definite possibility for twist offs and fishing jobs.

Conversely, if the joints are not tonged-up snugly, cracks may develop even in the absence of "wobble." The basic danger in loose tool joints is the occurrence of washouts (Figure 2). Field experience dictates a greater possibility for this occurrence in drill collars of seven-inch diameter or larger.

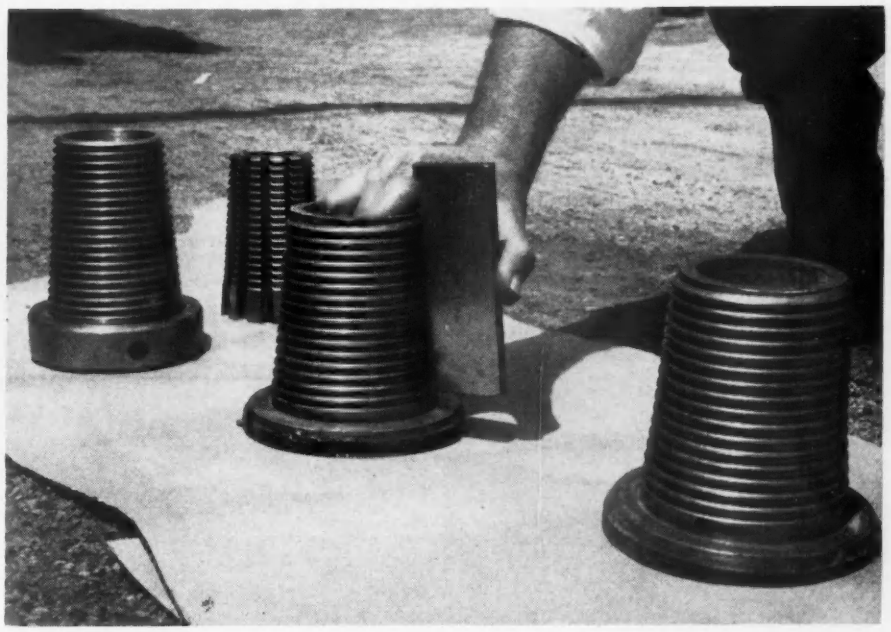


FIGURE 1. Illustration of pin stretch resulting from over-torqueing.

The Tong Torque Indicator

Magnolia has used the tong torque indicator for one year. Illustrated in Figure 3, this tool has been developed to permit the exacting measurement of torque created in the process of making-up and breaking-out drill collars. For rig service, the device is attached to the lead tong by means of a clevis, which permits a rapid assemblage of the equipment. Facilities have been provided for attaching a cable or rope to the other end of the indicator cylinder. Exertion on the cable is converted to hydraulic pressure for actuating the Bourdon tube in the pressure gauge. The pressure gauge is secured to the tong lever by a special bracket and is positioned

FIGURE 2. Loose drill collars encourage development of thread washouts.

to permit convenient inspection. The over-all weight of the unit is slightly less than 25 pounds; hence the mechanism may be connected with comparative ease.

The direct reading dial is calibrated to record a maximum cable pull of 15,000 pounds or 60,000 foot pounds of torque transmitted through a four-foot tong lever. The gauge is equipped with an adjustable needle which may be preset to the desired torque. With this device the driller can limit the travel of the torque needle according to the preset pilot needle.

The quick coupling adapter assembly permits rapid removal of the indicator prior to making connections or trips. Thus far, the tool has been employed only in the process of tonging drill collars.

Pulling Capacity Important

Field utilization of the tong torque indicator has revealed the pulling capacity of automatic breakout catheads to vary on different rigs. It has been found that the pulling ability of catheads on rigs of comparable design varies as much as 3500 pounds or 14,000 foot pounds. Further investigation revealed that, as would be expected, the pulling capacity of the cathead on large and small rigs varies from 5500 to 9000 pounds. Herein lies a serious problem, since application of the tong torque indicator has revealed that a 5500-pound pull will not effectively tighten collars exceeding a diameter of 6½-inch O.D. and a rig with a 9000-pound pull available is not capable of tightening 7¾- and 8-inch collars.

This factor greatly emphasizes the importance of the tong torque indicator, since it is generally held that the pull exerted by the breakout cathead is sufficient to tighten drill collars effectively. Since this is not the case, supplementary measures must be used. Greater power may be transmitted in collar makeup through the employment of a large rope, such as a catline attached as a jerk line on the backup tongs; or a double line and snatch block can be connected to the lead tong using the breakout cathead for tonging-up. Either of these applications will permit efficient tightening of drill collar tool joints.

Requirements for Makeup

The torque tonging of drill collars remains in an experimental stage because of so many variables, such as the type lubricant employed, condition of the threads and friction factors. However, manufacturers have done considerable work on the problem and in the process have developed tentative torque values (Figure 4). Field application of the tong torque indicator will permit a greater expansion of these data. If the joints show any indication of running loose, or the threads being distorted, the actual torque value that gives the optimum results can be determined for the size collar and the type joint in use.

An inspection of data shown in Figure 4 indicates the upper and lower torque limits. Derived from laboratory and field experimental investigation, the upper limit represents torque factors which will induce failures. In turn, the lower limit torque value theoretically insures closed drill collar shoulders. Between these two limits are three additional curves covering the safe operating

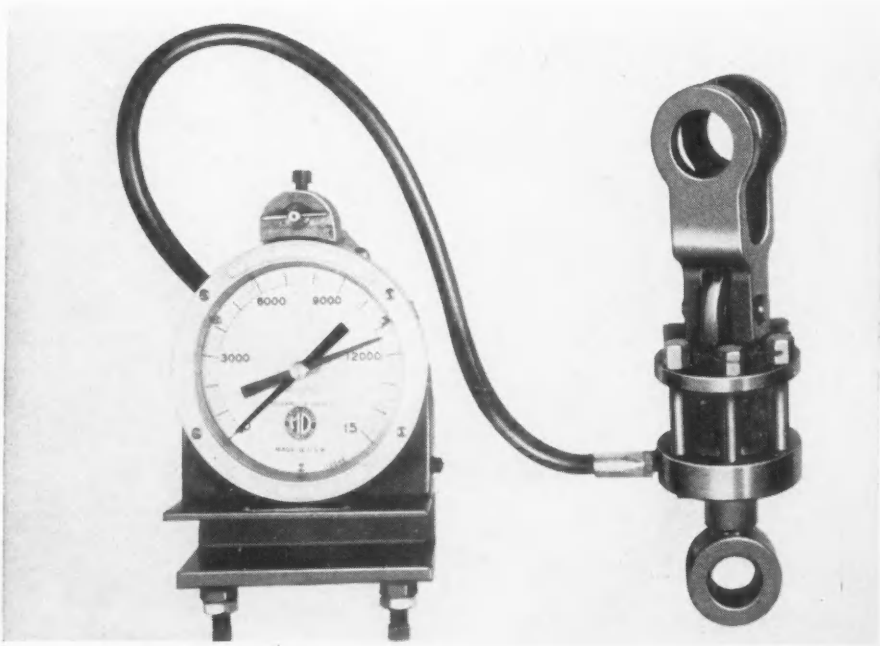


FIGURE 3. Tong torque indicator.

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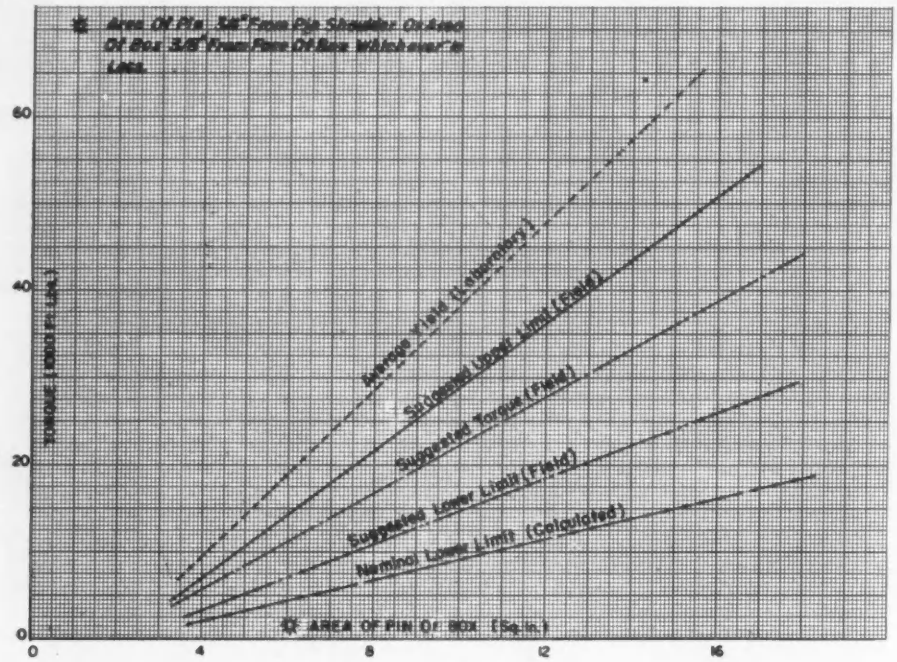


FIGURE 4. Recommended torque values based on area of box or pin.

range with the "Suggested Field Torque" curve as the optimum range.

The suggested torque values are a relationship of the cross-sectional area of the box or pin, whichever is the smaller. The cross-sectional area of the box is determined by calipering at a point ⅜ inch from the face of the shoulder. This area will vary with the outside diameter of the drill collar if identical joints are used. The cross-sectional area of the pin is determined at a point ¾ inch from the shoulder of the pin. Of course, this area on identical joints will vary in proportion to the bore of the drill collar.

Table 1 gives data on joints which are more often run, outside diameter of the joint, collar bore dimensions, critical area of boxes and pins, and the suggested makeup torque presented on the torque curve. The critical area of the pin is at a lower level and therefore is the weaker component of the tool joint. However, a majority of operators have experienced 50 percent of the failures in exposed box threads. The occurrence of these failures can be attributed to corrosion and fatigue.

It becomes apparent, from further inspection of the torque curve, that bore wear and outside diameter wear often make it necessary to change the suggested values, and in some cases, it will be desirable to change the type joint for a better balanced connection. It is suggested that each string of drill collars be treated separately and the more desirable torque be calculated to fit the condition of the drill collars.

Verification of the fact that the outside diameter wear and larger bore differ from the values shown on Table 1 as is illustrated by the following example: A 6¼-inch O.D. drill collar with a 2¼-inch bore, when equipped with a 4½-inch extra hole joint, requires 26,000 foot pounds for proper makeup. If the bore is increased to 3¼ inches, the cross-sectional area of the pin is reduced from 11.37 square inches to 7.1 square inches. The application of 26,000 foot pounds of torque to this joint will exceed the yield value, thereby damaging and distorting the threads. Therefore, to give optimum results, the torque must be reduced to 14,000 foot pounds.

Conversely, to permit tolerance for outside diameter wear, a 5¾-inch O.D. drill collar with a 2¼-inch bore and a 4½-inch full hole joint, requires 17,500 foot pounds of torque for proper makeup. If the outside diameter wears to 5½ inches, the cross-sectional area of the box is reduced from 7.4 to 6.2 square inches. To allow for this reduction in area, the torque should be reduced from 17,500 to 12,000 foot pounds.

Economy of Controlled Torque

Table 2 shows the operating days and footage drilled with four classifications of drill collars. The first period reflects operating data for a year prior to field application of the tong torque indicator and the second period represents a year following utilization of the indicator. The days and footage drilled by the four classifications of collars are comparable, yet the total time spent in fishing for drill collars has been reduced from 712 hours in the first period to 220 hours in the second. This results in a saving of 492 hours, or approximately $18,450, in rig time, based on a rig expense of $900 per day.

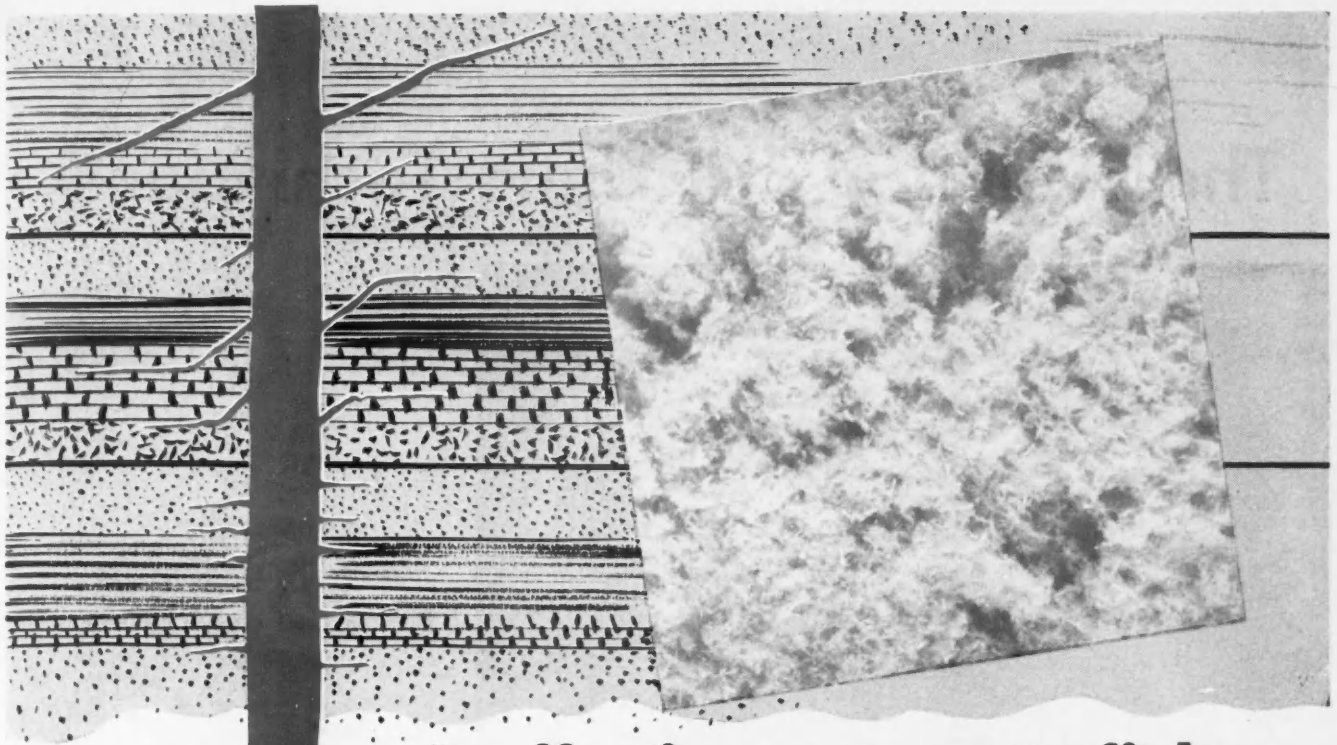
In conclusion, it is not implied that the tong torque indicator has been solely responsible for this saving; however, the tool has contributed greatly to these results since followup on drill collar failures shows that the practice of over-tonging and running loose joints has been greatly reduced.

Table 1

O.D. COLLAR	Joint	Bore	APPROXIMATE AREA		Suggested Torque
			Box	Pin	
8"	6⅝ Reg.	3	21.5	17.84	44,000
8"	6⅝ H-90	3	21.5	16.64	41,000
7¾"	6⅝ Reg.	3	18.2	17.84	44,000
7¾"	6⅝ H-90	3	19.0	18.84	41,000
7"	5 9/16 Reg.	2¼	14.1	16.62	34,500
6¾"	4½ H-90	2¼	17.7	12.0	27,000
6½"	4½ H-90	2¼	15.0	12.0	27,000
6½"	4½ X-hole	2¼	14.1	11.37	26,000
6¼"	4½ H-90	2¼	15.0	11.62	27,000
6¼"	4½ X-hole	2¼	11.5	11.37	26,000
6"	4 H-90	2¼	12.2	9.7	18,500
6"	4½ FH	2¼	9.6	11.17	21,000
5¾"	4½ FH	2¼	7.4	11.17	17,500
5¾"	4 H-90	2¼	9.7	8.57	18,500
5¼"	3½ H-90	2	8.2	8.59	17,000
5¼"	3½ IF	2	8.5	7.14	14,500
4¾"	2⅞ IF	1¾	8.23	4.66	7,500
4¼"	2⅞ IF	1¾	4.75	5.29	7,500
3⅞"	2⅜ IF	1½	5.15	3.03	3,000

Table 2

	SIZE											
	7¾"			6"			5¼"			4¾" or Less		
PERIOD	Footage	Days	Fishing	Footage	Days	Fishing	Footage	Days	Fishing	Footage	Days	Fishing
1st	115,720	492	206¾	183,420	1682	505¼	18,343	453	0	5,355	73	0
2nd	100,178	404	51¾	216,114	1647	117¾	36,652	797	39½	12,968	222	11



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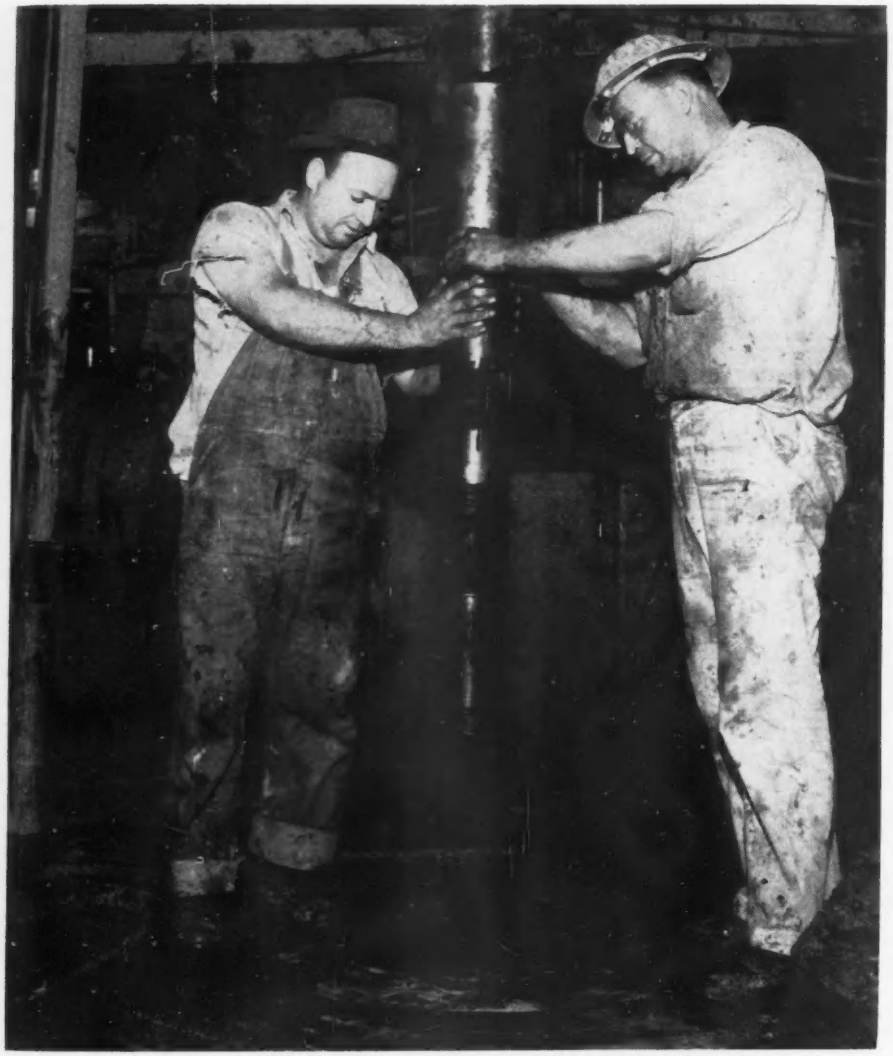
The Evolution of Fishing Techniques



Bottom hole tools have been perfected to a point where operations are completed with little difficulty. Trained crews, expert operating specialists and improved rig equipment insure efficiency.

By D. U. SKINNER
Houston Oil Field Material Company

PRESENTED HERE is a resume of fishing tools and techniques as developed from the first friction socket to our present day percussion methods. The article describes the basic function, application and background of modern oil well fishing equipment.

THE history and evolution of fishing tools is an interesting study reflecting a transition from crude, field fabricated apparatus to present techniques that assure a high average of successful recoveries. The early part of the twentieth century saw the fabrication of the first standard fishing equipment in the form of the friction socket. Construction of the friction socket included the use of casing sections, 6 to 20 feet long. The side section of the casing was torch heated and, with the aid of a sledge plus a pean hammer, the sides of the casing were indented approximately one-eighth inch at six-inch intervals. These indentations were imposed in either straight line or staggered designs, depending upon the preference of the operator. The lower four-foot section of the casing remained untouched so it would serve as a sleeve-type guide.

When employed as a fishing tool, the friction socket was attached to the drill string, lowered into the hole, and guided over the fish. Proper engagement of the tool involved dropping the drill pipe a short interval to jam the indentations in the socket around the fish and, in this manner, a secure friction lock was established. Though simple to engage the fish, it was utterly impossible to release the friction socket in the event the fish would not become free enough to pull. Thus, it was often necessary to exert dangerous lift pulls by means of the drill pipe, a procedure extremely hazardous when performed on the wooden-type, turnbuckle derricks.

After the fish was securely engaged within the friction socket, the general practice was to lower the water level in the boilers, increase the fuel flow to the burners, and tie down the safety valves with the resultant production of what was known as "blue steam." At this point the engine would transmit maximum power, a factor governed by the strength of the wooden derrick, to the drawworks in an attempt to pull the fish. In the

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event the fish could not be recovered with the regular number of lines strung on the blocks, a luff-line, which consisted of another set of blocks, was connected in conjunction with the regular traveling equipment. This procedure permitted the exertion of additional force in the attempt to remove the fish.

Sway bracing was often resorted to when it became necessary to apply abnormal loads on the derrick. However, even with this precautionary measure in force, it was not unusual to pull a derrick in or, at least stress the members to a point whereby splinters would shower the rig. It is not difficult to understand why the derricks were so often grounded during the process of retrieving a fish.

The prevailing limitation of the wooden derrick seemingly presented the predominating problem. Although the usual practice involved pulling on a stuck fish until the derrick collapsed, some of the more cautious operators resorted to other more practical procedures. For example, if the friction socket nor the fish could be removed, it was the customary practice to run another string of drill pipe and a friction socket tooled with left hand threads. With this equipment available, it was possible to back off drill pipe connected to the friction socket engaged on the stuck fish, and finally work down to the fish proper. Although a lengthy, precision operation, the early day drilling tool operator found it possible to retrieve stuck drill pipe in this manner. A difficulty encountered was that often the pipe would back off in two different places, one segment would drop along side the engaged fish, and in all probability it would be necessary to skid the rig.

The limitations of the friction socket prompted the operator to devise the bulldog overshot and the tapered tap. The latter tool, though an early fishing apparatus, is still considered adaptable to present fishing technique. The introduction of the bulldog overshot and tapered tap was not accompanied by the development of the safety joint; hence, it was quite difficult to remove these tools from a fish in case of failure in retrieving the stuck equipment.

The construction features of the bulldog overshot included a segment of pipe which had been heated and swedged down to a smaller diameter in the center section. Tailor-made for each individual fishing job, the bulldog overshot was equipped with a split slide ring with an outside diameter comparable to the inside diameter of the tool. In turn, the ring was machined with an inside diameter paralleling the outside diameter of the fish.

A bulldog overshot ready to run in the hole. Although one of the early type fishing tools, is often called on to assist in present-day fishing operations.

The split ring insert was placed in the upper chamber of the overshot and, when lowered around the fish and moved in an upward direction, the ring clamped around the fish and locked against the swedged section of the tool. In this manner, the fish was securely retained within the bulldog overshot for ultimate transport to the surface. Since the metals were of a near comparable hardness, the engaged ring would generally lock into position—thus preventing a successful disengagement of the tool.

The early pattern of the tapered tap has been subjected to few changes through the years. The early model consisted of a tapered, threaded body which was center bored and equipped with four vertical splines, grooved to an approximate depth of 3/16 inch. The presence of the vertical boring permitted the circulation of fluid through the tool. The spline feature permitted the return of fluid through the annulus and, if it was desired to remove the tap, the circulation of abrasive, sand-laden fluid would ultimately erode the tap to a point wherein removal would be possible.

Hardening of the tapered tap was accomplished by heating the tool and quickly submerging it in crude or cyanide. The correct hardness of the metal was attained through trial and error method.

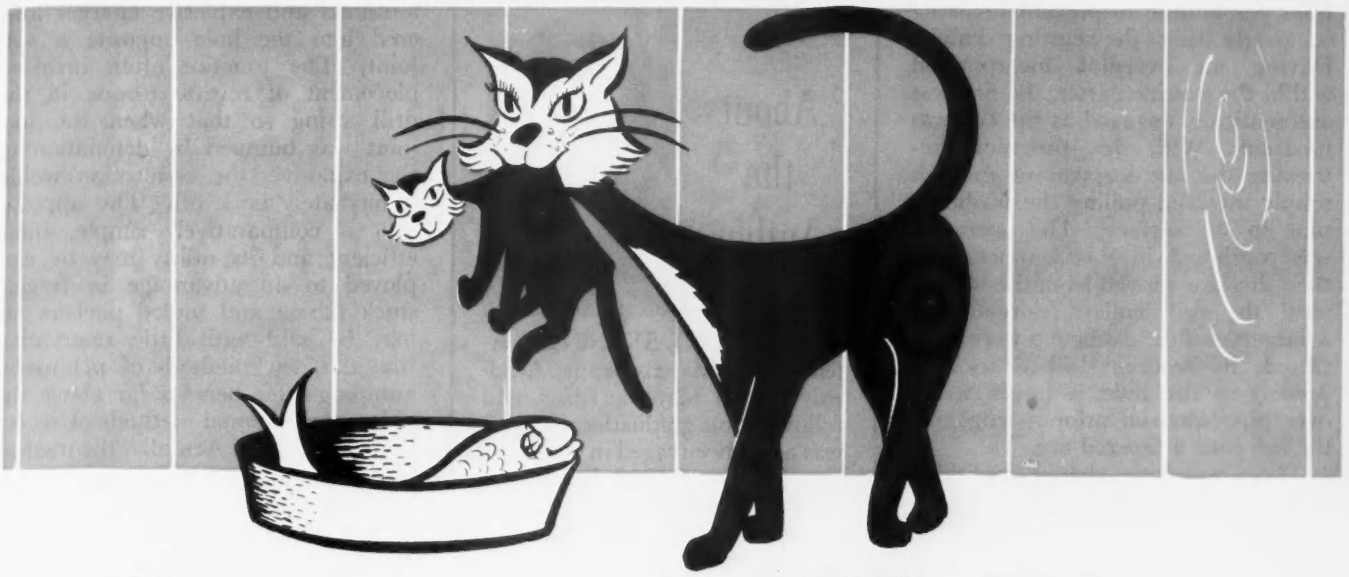
Prior to 1920, it was customary to remove stuck fishing tools with heavy nitroglycerin charges—a technique of questionable utility since the fishing tool, casing and drill pipe suffered serious damage. Although the method was often employed, many operators preferred backing off and sidetracking the hole.

The process of sidetracking envolved the application of a novel and often workable procedure. Initial preparation for the sidetracking procedure involved requisitioning a cypress log pointed at one end and hand-sculptured to a 45 degree angle on the remaining end. The log was then shaved to the approximate inside diameter of the well bore, penetrated with numerous holes in the side, and segments of drilling line were anchored in the side openings. The short sections of the drilling line were allowed to extend approximately one inch beyond the side of the cypress log.

At this point, the cypress log was guided to bottom with the drill pipe and, with the introduction of weight, the pointed end of the log was engaged at any desired depth. The log was allowed to remain undesturbed for several days to permit sufficient swelling to jam the drill line segments into the side of the well bore. With the cypress properly in place and the cables extending into the side of the well bore, there was little possibility of this improvised plug becoming free during the process of sidetracking operations.

The early part of 1920 saw the development and field application of retrievable, detachable overshots—a definite landmark in the improvement of fishing tools and the associated technique. During the same period, the washover shoe was introduced and with this tool available, it was possible to fabricate the outside cutting device.

The process of outside cutting initially required conditioning the hole with the washover unit. Generally consisting of 500 feet of casing and a rotary shoe, the washover pipe was employed to remove formation from around the fish. At this point, the washover pipe was removed from the hole and the outside cutting device was substituted for the rotary shoe. The process of cutting was accomplished by slowly raising the cutter until a tool joint was engaged thereby forcing the knives against the pipe. The drill string was then rotated to the right at approximately 14 revolu-



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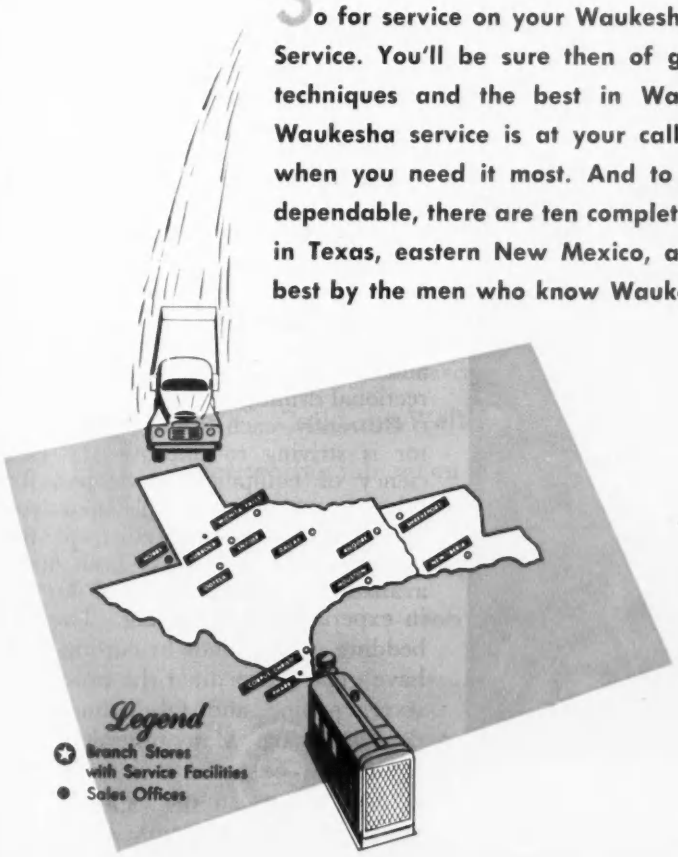

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tions per minute to prevent breaking or overheating the cutting knives. Having an overshot incorporated within the outside cutter, the fish was automatically engaged as the cut was finalized. With this provision, retrieving the cut segment of the fish simply involved pulling the washover pipe to the surface. The operation was continued in this manner until the fish was removed from the hole or until the drill collars, normally of a larger outside diameter, were contacted. In the event drill collars were present in the hole, a larger washover pipe was run prior to engaging the fish with a tapered tap.

There was little change in fishing tools and fishing techniques until early 1934, when the inside cutting technique was initially introduced as a field-proven tool. Application of the technique was made possible through the introduction of small diameter or "macaroni" pipe. At the time, the exact location at which the drill pipe was stuck could not be accurately determined; hence, it was often necessary to make several cuts before a section of the drill string would become free.

Run in the hole on the small diameter pipe, the cutting device was anchored inside the fish by means of engaged slips. Operation of the tool involved right hand rotation to open the cutting blades and simultaneous lowering of the cutting string to engage the device. Continued rotation of the cutting string resulted in the ultimate severing of the fish. A revolutionary development to the drilling tools operator, the technique remains widely practiced even today.

About the Author

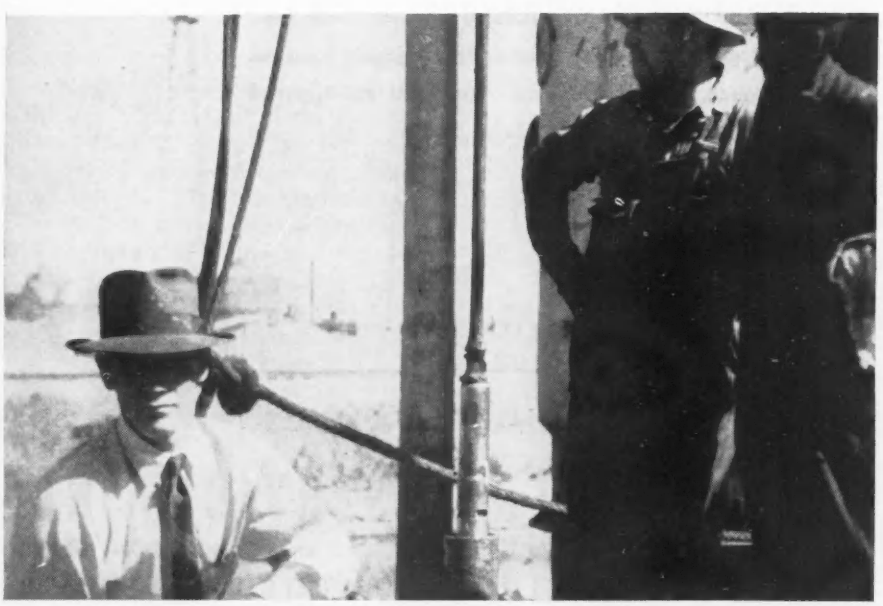
D. U. (DOC) SKINNER attended San Marcos Baptist Academy at San Marcos, Texas, and following his graduation in 1916, was actively engaged in Naval assignments until 1919. From 1922 until 1924, he was affiliated with the Humphrey Oil Company in the Mexia fiield. Between 1924 and 1937, he was associated with pipe line, production and drilling operations. In 1935 he joined the Stone Oil Tool Company as a fishing tool operator. Continuing in this profession, he joined Houston Oil Field Material Company in 1937. Except for his assignment as vice president and general manager of Homco Service, Inc.,—Venezuela, S. A., he has been in active contact with extensive fishing operations in the U. S. Currently, he acts in the capacity of service and manufacturing representative for Homco.

The inside cutting method remained quite popular until after World War II, when techniques were developed whereby the stuck section of the fish was scientifically predetermined and explosive charges lowered into the hole opposite a tool joint. The practice often involved placement of reverse torque in the drill string so that when the tool joint was bumped by detonation of the explosive, the connection would immediately back off. The application is comparatively simple, quite efficient and its utility may be employed to an advantage in freeing stuck tubing and fouled packers. It may be said with little reservation that the new methods of percussion bumping offer benefits far above the older, conventional methods of recovering stuck pipe. Actually, the method is utilized to an advantage in a majority of present-day fishing jobs. Of course, the advantages offered by this technique are often greatly enhanced through the simultaneous application of washover pipe and associated devices.

An analysis of present fishing techniques indicates that, as a usual practice, the overshot is employed in case of twistoffs and to re-engage drill pipe prior to inside cutting. The tapered tap is normally employed when it is impossible to guide a tool over the outside diameter of a fish. Primarily applicable to the recovery of drill collars, the tapered tap is seldom employed in the recovery of drill pipe. The internal, explosive percussion technique has definite application in a majority of the fishing jobs; in fact, there are few jobs where the method cannot be employed to a definite advantage. Finally, even with our modern fishing devices and improved techniques, it is often necessary to resort to sidetracking in the process of salvaging a hole. Although the percent requirements for the employment of sidetracking have become increasingly low, occasionally it is necessary to resort to the method because of the time consideration in the process of recovering a fish.

Of course, sidetracking is becoming increasingly important in Gulf Coast and continental shelf controlled, directional drilling.

Currently, each fishing tool operator is striving to improve the efficiency of equipment developed for this purpose. For example, new type jars, which are actuated from the bottom of the hole, have been made available and other improved jars are in experimental processing. The imbedding of diamonds in cutting tools have greatly expedited the process of severing pipe and fabricating windows in casing. Many other improvements may be noted that have been a distinct asset in the expediting of efficient fishing programs.



Initially, the inside cutter was run on a string of sucker rods. This practice is still employed in minimum inside diameter pipe while strings of slim hole drill pipe are utilized in big inch cutting operations.

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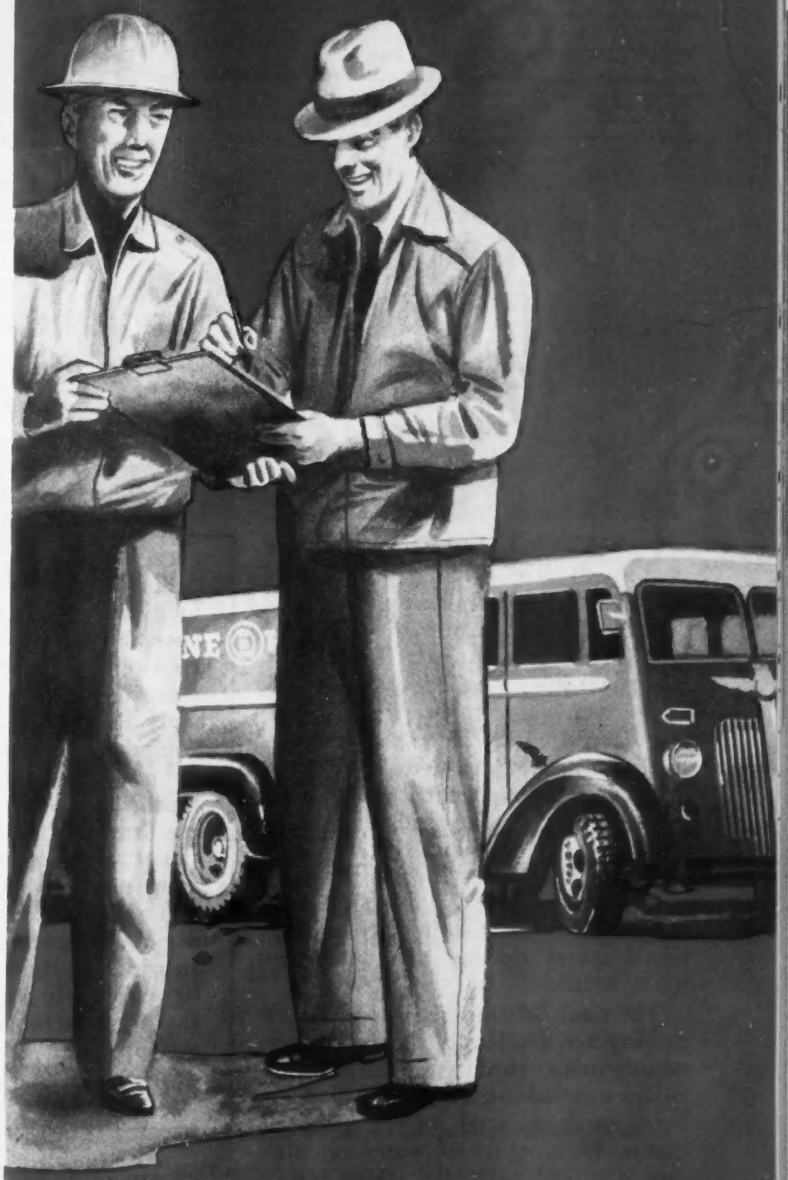

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Wet Auger Drilling Of Seismograph Shot Holes

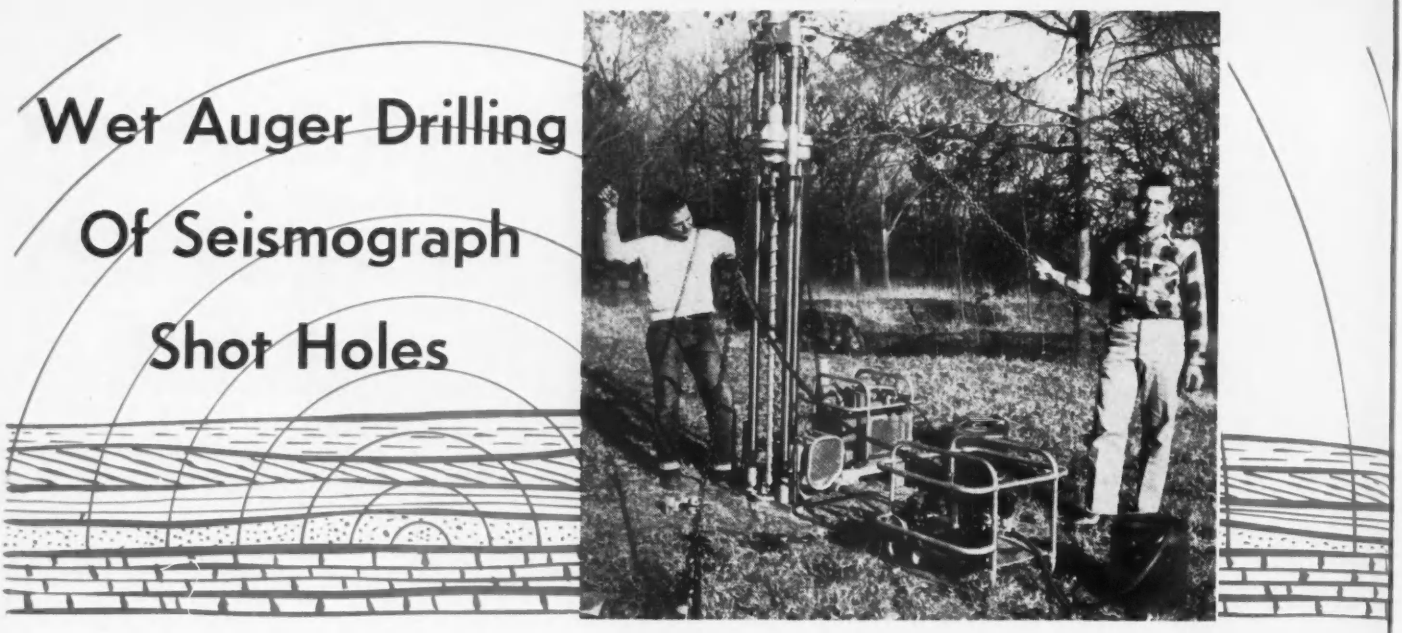

FIGURE 1. Portable shot hole drill developed by The Carter Oil Company. Here the rig is set up for wet auger drilling.

By JOHN M. CAMP
Development Engineering Section,
The Carter Oil Company Research Laboratory

A WATER-LUBRICATED auger method of drilling seismograph shot holes has been developed by engineers of The Carter Oil Company Research Laboratory. This "wet auger" drilling method uses a small amount of water to prevent sticking of cuttings, which are removed from the hole mechanically by the auger conveyor. When necessary, water is injected through the drill string and out at the bit in quantities of about 20 to 35 gallons per 100 feet of hole, as compared to the 100 to 300 gallons ordinarily circulated in the conventional rotary drilling method to remove cuttings.

The basic advantages of wet auger drilling are drastically reduced water consumption, elimination of lost circulation problems, more easily loaded holes, and reduced casing requirements. Elimination of water circulation not only eases the water transportation problems, but also greatly reduces pump requirements, thus minimizing the weight of the drilling equipment. Since no circulation is required, lost circulation problems accompanying very permeable or cavernous formations are eliminated. Easy-to-load holes usually result because hole condition is improved by mechanical action of the auger. Auger-drilled holes are ordinarily straight walled, and of constant diameter, without washouts or ledges. Furthermore, pebbles and small boulders are pushed aside and packed into the hole wall so as to cause no trouble. Casing requirements are reduced by the plastering action of the auger drill. For instance, it has been found that when clay sections are drilled below a caving sand section, the sand section is packed off with clay by the action of the auger.

A LIGHT, PORTABLE shot hole drilling unit designed to operate with minimum water requirements is described. Developed by the Carter Oil Company Research Laboratory, the equipment is especially adapted to areas which cannot be reached by means of automotive transportation. Conventional shot hole drilling equipment normally requires 100 to 300 gallons of water circulated per 100 feet of hole penetrated. In contrast, the Carter unit can be efficiently operated with the introduction of 20 to 35 gallons per 100 feet of hole drilled.

The wet auger method was developed as the result of an assignment to build a drill to be carried by manpower in areas where the use of automotive equipment is not feasible. Such conditions require not only extremely portable equipment, but also the least possible amount of auxiliary supplies, particularly water. For this reason the auger drilling approach was selected. Although it was found that under some conditions augers could be used without any water other than natural ground water, for general use the water injection method was most satisfactory. Primarily designed for wet or dry auger drilling, the Carter drill is also adaptable to conventional rotary drilling for penetration of extremely hard formations.

The drill assembled for wet auger drilling is shown in Figure 1. Excluding drill stem, the equipment shown weighs 913 pounds. For rotary drilling the injection unit (consisting of a pump, 1½ horsepower engine, and frame, totaling 108 pounds) is replaced by a ten-horsepower engine and pump unit weighing 285 pounds. This equipment is shown in Figure 2. In either setup a ten-horsepower engine rotates the drill string and powers

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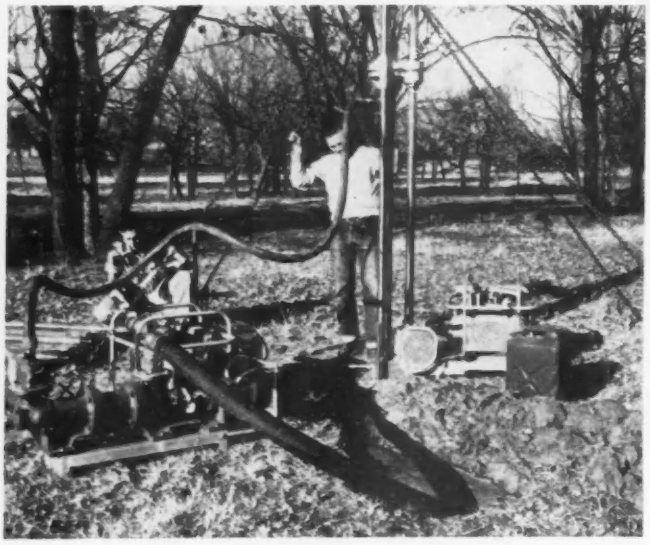

FIGURE 2. Versatility is a feature of the portable shot hole drill. Here it is shown equipped with rotary string instead of auger and with injection unit consisting of ten horsepower engine and pump unit.

About the Author

JOHN M. CAMP entered the petroleum industry in 1938 after 10 years of design engineering in manufacturing industries. His first assignment was with The Carter Oil Company's production research group as a draftsman. He later spent two years in the field as drilling and production engineer and in 1946 returned to Carter's Research Laboratory, where he was assigned to the Development Engineering Section. Camp's work as a research engineer is mostly concerned with drilling problems.

the hydraulic hoist and pulldown unit at the top of the drill. The machine can be dismantled for moving as shown in Figure 3 in less than 15 minutes. Re-assembly and setting up for drilling requires approximately 30 minutes. Tools required for these operations are a sledge and a 24-inch pipe wrench.

A large factor in the success of the equipment in drilling through a great variety of formations is the use of relatively high weight on the bit. This is achieved by the hydraulic pulldown unit, which furnishes up to 3000 pounds weight on the bit, and up to 5000 pounds pull as a hoist. Since the drill proper weighs less than 800 pounds, it is anchored to the ground by the four chains and special ground anchors shown capable of withstanding the full 3000 pound pulldown force. Convenient hydraulic controls speed up the drilling operation.

The drill has been tested in northeast Oklahoma, southwest Arkansas, the Texas Gulf Coast, and in the Alberta Province in Canada. In tests of the wet auger technique, it has successfully penetrated sand, quicksand, sandstone, sandy clay, clay, shale, gravel, and a sticky clay or gumbo containing gravel. In these trials the portable drill reached 165 feet depth —the maximum required for effective shooting during the tests. Using the standard rotary drilling method, the equipment has drilled to 200 feet. Drilling rates with the wet auger method have averaged roughly one minute per foot for a large variety of formations, and for hole depths varying from 65 to 165 feet.

Although the tests were intended primarily to evaluate the portable drill, a secondary result was the demonstration of the value of wet auger drilling of shot holes. The field tests have created a demand for wet augers and drills adaptable for such use, and it is believed that as its advantages become widely known, wet auger drilling will be extensively used for drilling seismograph shot holes.

Licenses to use the Carter drill are available from Standard Oil Development Company, to which all patent rights have been assigned.

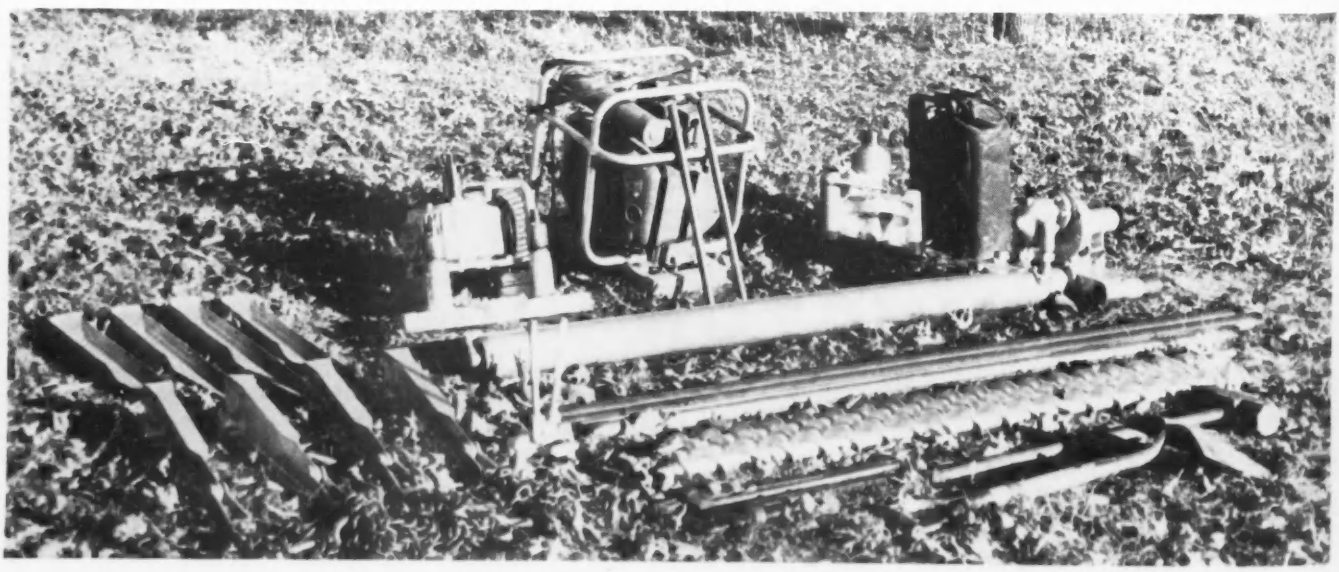

FIGURE 3. Carter's water-lubricated auger used for shot hole drilling is shown dismantled and ready for moving.

What more can we say?

Bill Duke, drilling superintendent for Lohmann-Johnson Drilling Company, watching a string of REED Super Shrink-Grip Tool Joints being applied at Plainville, Kansas.

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Bill Duke
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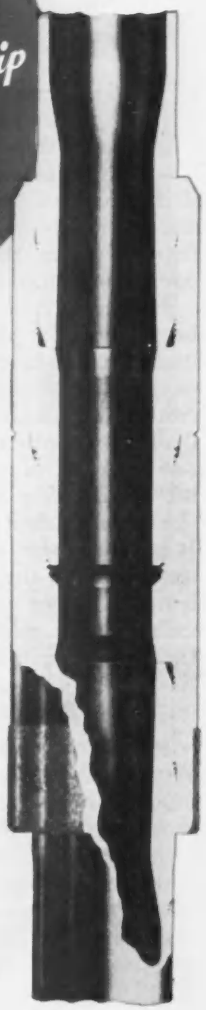

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Crooked Holes

By BRUNO SCHABARUM
General Manager, Carl B. King Drilling Company

WITH THE innovation of more rapid drilling rates, weight applied on the bit has been increased to a point ranging between 20,000 to 40,000 pounds. The net result has been increased footage with the accompanying problem of crooked holes. This discussion of crooked hole problems was presented at the Eleventh Annual Meeting of the American Association of Oilwell Drilling Contractors.

THE term "crooked holes" is a rather loose definition of the problem to be discussed. In the drilling industry a hole is crooked if the slope of the hole is away from the vertical by 3, 4, or 5 degrees, depending upon the limits set by the operating company.

Historically, crooked holes have been with the drilling industry for many years. In the Seminole, Okla., boom, several stories are told of one contractor running into a hole being drilled by another. During those times one or two drill collars were used, but bit weight was secured by running the 6⅝-inch drill pipe in compression. It is conceivable that this contributed materially to the crooked hole problem. In those days instruments to measure the angle of inclination of the hole were not used.

Recent Problem

In regard to the Permian Basin of West Texas, crooked holes were not much of a problem prior to 1945. In those days the drilling weights on 8¾-inch bits were about 15,000 pounds, and about 12,000 pounds on 6¾-inch bits. When it was learned that much faster rates of penetration could be obtained by increasing bit weights, the problem of the hole working away from the vertical became more important.

Today, most contractors are running from 40,000 to 60,000 pounds on 8¾-inch bits and from 20,000 to 40,000 pounds on 6¾-inch bits. These additional bit weights are being obtained by running drill collars, and even though the collars are stiffer than the pipe, the formation still exerts a sufficient reaction to cause the hole to deviate in some cases.

Another factor that has aggravated the problem is that as the wells become deeper, formations below the massive Permian limes and dolomites are penetrated. Some of these formations are shales; others are layers of limestones and sands and cherts. Changes of formation are conducive to making the bore hole travel away from the vertical.

As the wells become deeper, the rock also assumes greater physical strength, and requiring greater bit weight for penetration. Any fracture or voids which may be at an angle will decrease the reaction in that direction and, accordingly, the hole will deviate in the same direction.

The speed of rotation also seems to have some influence on crooked holes. As bit weights have increased, it has been found advisable to decrease rotating speeds to secure satisfactory life of the bearings in the cones. Slower bit speeds seem to be conducive to hole deviation.

Any factors which decrease drilling rates such as high viscosity or low water loss of the drilling fluid are conducive to crooked holes. This statement is made because not one instance is recalled where a crooked hole was experienced while drilling with water.

Obviously it is easier and less hazardous to keep a hole straight than to straighten one after it has gone crooked. The best means of doing this is to use drill collars of as large a diameter as the hole and fortitude of the operator will permit. Arthur Lubinski of Stanolind Oil & Gas Company's Research department has recently pointed out the above by theoretical treatment of the problem. He shows that a 6¼-inch diameter drill collar string will buckle when the bit weight exceeds 8500 pounds while an 8-inch diameter drill collar string will require 16,300 pounds before it buckles. These figures apply when using both strings in 9-inch holes. In 8¾-inch hole, this condition should be some better.

Larger Collars

About three years ago, the Carl B. King Drilling Company began to use larger collars in holes which tended to go off the vertical. Today we use 8-inch collars in 8¾-inch hole; 7-inch collars in 7⅞-inch holes, and 6¼-inch collars in 6¾-inch holes. Generally, only five or six large collars are used at the bottom of the string and the rest are reduced in diameter. While this practice seems to help, it is not a definite cure-all for the problem.

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pany has also resorted to a bladed stabilizer above the bit. The tool is 10 feet long with a diameter across blades of 8⅝-inch for use in 8¾-inch hole. The 7⅞-inch hole tool is 7¾-inch outside and the 6¾-inch hole tool is 6⅝-inch outside. This stabilizer is run immediately above the bit. Some thought has been given to running two stabilizers, one immediately above the bit and the other on top of the lowest collar. This scheme may have merit as the guided section will be considerably longer than at present.

Keeping the rotary speed up to at least 80 revolutions per minute will also help keep the hole closer to vertical.

After a hole has approached the limit of deviation allowed, then the problem of straightening is present. The first thought is to hold up the weight and spin the rotary up to 110 to 120 rpm. It is natural to assume that this practice will straighten the hole because this was the normal method a few years ago. But it is also true that the rate of penetration falls way off and if the bit does not make hole, then the deviation cannot be decreased.

Whipstock Aid

Setting an oriented whipstock at the bottom of the hole and kicking the hole back also has possibilities. Sometimes, however, the whipstock turns and the hole is in much worse shape than originally.

In numerous cases the deviation has exceeded the figure set by the contract, but the contractor was allowed to continue to drill for the reason that it was felt that there was no practical way of producing a hole whose deviation was less than that required by the contract. Further, there is considerable question that a simple deviation test means very much from the angle of practical production practice.

The deviation clause in a contract is thought of as limiting the horizontal drift of the bottom of the hole with respect to the top of the hole. This association is incorrect for the reason that most instruments in common use only measure the angle to the vertical of the tangent to that section of the hole which is being measured. It can be easily seen that a high angle of deviation may still permit the hole to bottom very close to a point directly below where the hole was started.

Another reason for specifying low deviation angles is fear of running casing and later production problems. At Long Beach, Huntington Beach and other coastal fields in California, some wells deviate as much as 30 and 40 degrees. No particular casing or production problems are encountered.

There is not much question that living up to the deviation clause in the drilling contract is one of the most serious difficulties confronting the drilling contractor. It is time that a concerted effort be made to solve this problem. The Mid-Continent District, American Petroleum Institute, has a study committee working on the problem. Their approach is to try to devise ways of drilling straight holes. So far, they have advocated the use of larger and larger drill collars. We have complied with this practice for several years and suspect that it is not an absolute solution.

Committee Proposed

We propose the formation of a committee sponsored by the American Association of Oilwell Drilling Contractors which would have as members both contractors and operating company personnel. Their first obligation would be to determine exactly the reasons for including the deviation clause in the contract, and to determine the end result desired.

This procedure is highly desirable because the deviation clause in a contract is indefinite and does not necessarily secure the results required; further, in attempting to comply with the clause, great expense is forced upon the industry. To substantiate and indicate the thinking of some of the producing companies, we would like to report that one large operating company has removed the deviation angle entirely from their contract. Their contractors still run straight hole surveys and efforts are still made to keep the holes reasonably straight.

Three large operating companies in the Permian Basin, while they have not removed the straight hole clause, advise that they have liberalized it because they realize it is practically impossible to stay within the limits commonly accepted in the past in certain areas. One of these companies requests that the rate of change of deviation be confined to one degree or less per 100 feet of hole, if possible.

Another operating company has made it a practice to run a directional survey of the hole whenever it seems crooked. If the survey indicates that the bottom of the hole is in a cone of a given size whose vertical axis passes through the center of the location, and if the rate of change of slope is not too great, then they permit the contractor to continue drilling even though the slope test is considerably above the upper limit specified in the contract.

As we drill deeper and faster this problem will become more expensive and more significant. It is therefore earnestly suggested that some action be taken on this matter by the industry in the immediate future.

About the Author

BRUNO SCHABARUM became a member of The National Supply Company's Toledo engineering staff following graduation from the California Institute of Technology in 1926 as a mechanical engineer. Schabarum's appointments with National included engineering, sales and managerial duties until 1944, when he joined Carl B. King Drilling Company. In 1949, he was promoted to general manager of this organization. Schabarum has been responsible for the development of many improved machinery designs and drilling techniques.

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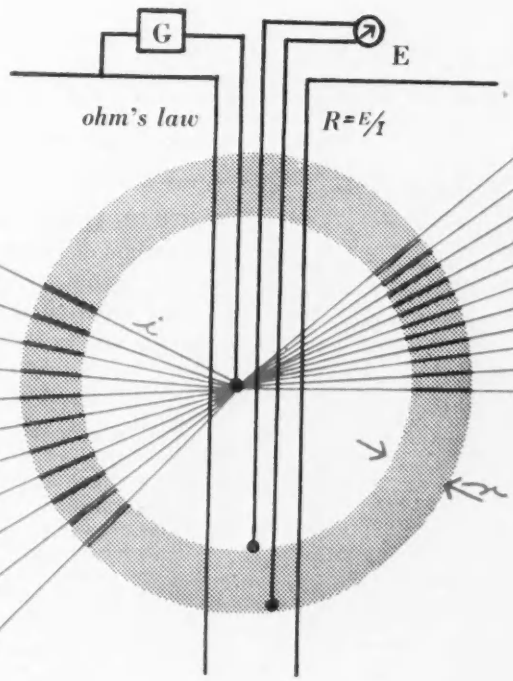

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Simultaneous Radiation Logging in Kansas

FIGURE 1. Typical field setup for simultaneous radiation logging. The small panel truck in the foreground houses necessary recording devices. The larger truck is a standard gun perforator unit complete with hoist.

By V. J. MERCIER

Division Manager, Perforating Guns Atlas Corporation, Wichita, Kansas

DESCRIBED HEREIN is a new method of measuring radioactive phenomena which permits the simultaneous recording of the gamma ray log, the Brons neutron log, and a casing collar log. Field application of the method allows substantial savings in rig time plus optimum accuracy in log interpretation and correlation.

A NEW method of measuring radioactive phenomena permits the simultaneous recording of the gamma ray log, the Brons neutron log, and a casing collar log, resulting in a significant saving in rig-time while increasing accuracy in log interpretation and correlation. Measurement of the radioactive content of geological formation, plotted against depth, was commercially introduced in 1940 as the gamma ray log. In 1943 a second log was introduced which became known as the 'Neutron' log. These methods of oil well survey remained unchanged until 1950, when the simultaneous radiation logging technique was introduced.

In order to better demonstrate the principles and characteristics of the simultaneous radiation log, it appears worthwhile to trace the commercial evolution of radioactive well logging.

Gamma Ray Logs

A gamma ray log is a measurement of the natural radioactivity occurring in the strata of the earth. Measurable quantities of radioactive material are found in all sedimentary beds in varying amounts. The small quantities of radioactive emanations from these formations can be and are detected by an extremely sensitive instrument lowered into the well bore on an armored conductor cable. Various formations are recognized and identified by their radioactive characteristics. As a general rule shales have a high radioactive content while limestone, sandstone and dolomite are quite low in response.

There are three systems presently available for the recording of gamma ray logs. The system introduced in 1940 employs a 36-inch ionization chamber method of detection, while the two later developments both use the well known "Geiger-Muller Counter" principle. All three recordings are very similar in appearance and are similarly interpreted. High response is indicative of shale; low radiations indicate limestone or dolomite. Where the Geiger-Muller type counters are employed it is possible to scale the recordings in "Micro-Roentgens Per Hour" units.

Neutron Logs

A gamma ray log is a measurement of natural radioactivity; neutron logs are a measurement of artificial or induced radiation—or a measurement of one of the effects produced by bombarding the formation with a strong source of neutrons. Two methods are currently available to the industry.

One system employs an ionization chamber which is sensitive to secondary gamma ray radiations driven from the formation as a result of the neutron collisions.

A more recently developed system employs a slow-neutron counter which operates somewhat similar to the familiar Geiger-Muller Counter. By means of this slow-neutron counter, neutrons that have reached a certain energy level, or neutrons that

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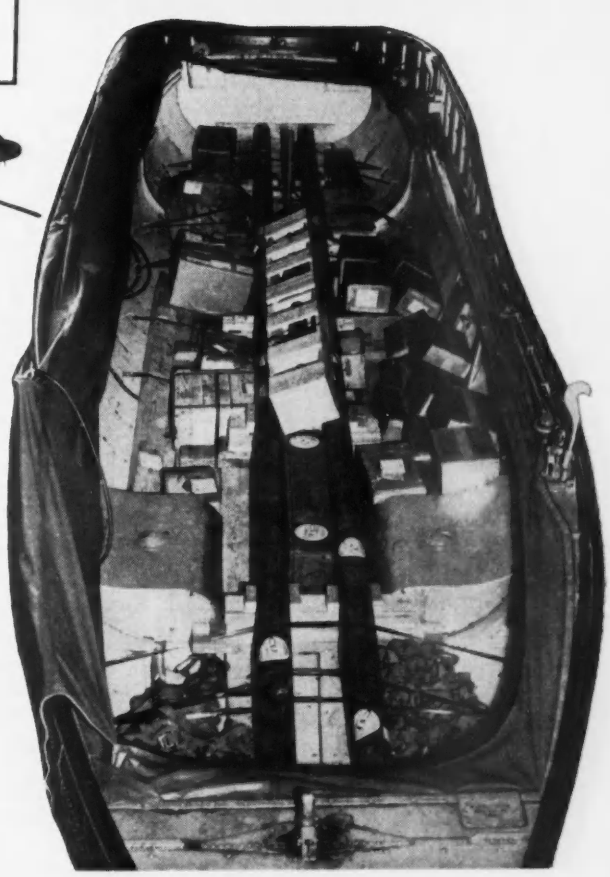
D & S core barrels and Truco diamond bits are being loaded into this plane at Dallas for a quick trip to Miami. Diamond core barrels can be transported by air, domestically and foreign, and still save the operator money. Actually, only one day of rig time saved, on an average depth hole, will pay approximately 2,000 miles of air freight cost.

Photo courtesy Delta Air Lines

READY FOR FLIGHT

A core barrel ready for quick delivery to Venezuela lies in this huge pod, appropriately named the Speedpak. It attaches to the belly of Constellation planes and is capable of handling a pay load of 8000 pounds, which is equal to the pay load of most twin engine cargo planes.

Photo courtesy Chicago and Southern Air Lines



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have been slowed down by their passage through the formation, are recorded.

In both instances the effect is virtually the same. Where high hydrogen content is encountered in the strata the primary neutrons are absorbed or effectively slowed, therefore producing a low energy recording. On the other hand where very little or no hydrogen is present a high recording is obtained. It becomes apparent then that the same basic interpretive rules would apply to either system. High radiation indicates very little or no fluid content while low response would indicate a porous zone.

Casing Collar Logs

Since both the gamma ray log and the neutron log can be obtained through the walls of the steel casing, either one or both of these logs is usually employed after the well is cased. In the desire to eliminate measurement discrepancies, several methods of locating casing collars have been developed. The casing collar locator is usually run as a part of the gamma ray log.

Two types of electrical locators are seemingly the most popular at present. One type of electrical collar locator is of the magnetic type in which the instrument must be kept in contact with the casing to operate properly. In this type the casing collar is located by the gap, usually existent at the collar joint, causing a change in the magnetic field.

A new development in collar log techniques is an electrical locator that works on the induction principle. Features of this collar locator are: the instrument is not required to be in contact with the casing; it will locate collars in screen or slotted liners and flush-joint casing, and usually will locate the casing centralizers. This latter locator is employed as a component in the simultaneous radiation log system.

Combination Logs

In some oil areas either the gamma ray log or a neutron log would be sufficient; but in most areas, and especially Kansas, a combination log composed of the gamma ray, the neutron and the casing collars is required.

When instruments of the ionization chamber type are used, the gamma ray log and the collar log are recorded together on one run into the well. On the second round trip into the well the neutron log of secondary radiation is recorded. These two separate recordings can then be retraced to provide the well operator with a combination log.

By employing the counter method of detection, a simultaneous combination log is possible. The gamma ray log, the Brons neutron log, and the induction casing collar log are all recorded simultaneously on a single round-trip in the well. Obviously, the rig-time consumed is much less by this method and an accurate continuous paralleling of component logs is obtained.

Simultaneous radiation logs were made available to the oil industry in Kansas in late September, 1950. Without the rapid advancement and recent discoveries in nuclear physics and the atomic sciences the simultaneous recording would not have been made possible. Figure 2 is a simplified line drawing illustrating the main components of the Simultaneous Radiation Log. The subsurface instrument houses a neutron source, a slow-neutron counter, a pulse transmitter, a Geiger-Muller counter, and an electrical collar locator. The recordings obtained are transmitted to the surface on a single conductor wire line where they are detected, amplified, and plotted on a pen recorder synchronized to the depth of the instrument in the well. It will be noted that the three pens of the recorder are in direct relation to the component logs in the well. The subsurface instrument is 3⅝ inches in diameter and approximately 12 feet long. The collar log is 11 feet from the bottom of the instrument; the gamma ray is 8 feet from the bottom; and the neutron recording point is 1 foot from the bottom.

Obviously in the development of a simultaneous recording system a very detailed, exhaustive research was carried out to determine the accurate

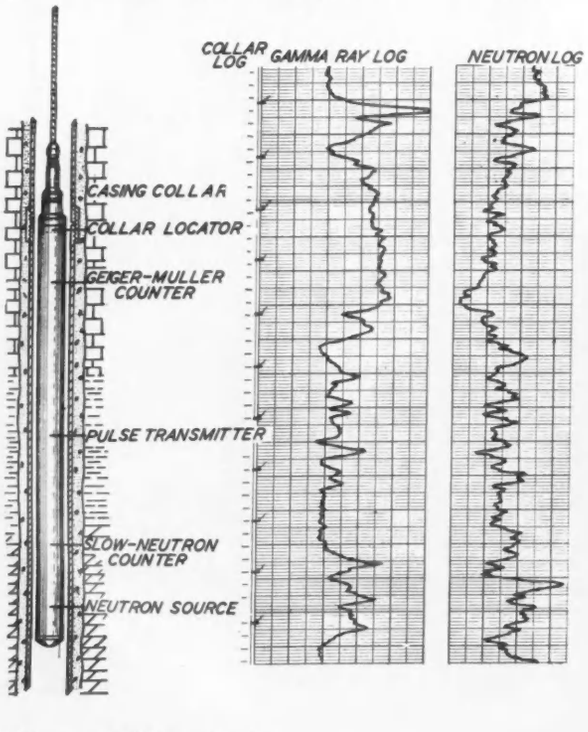
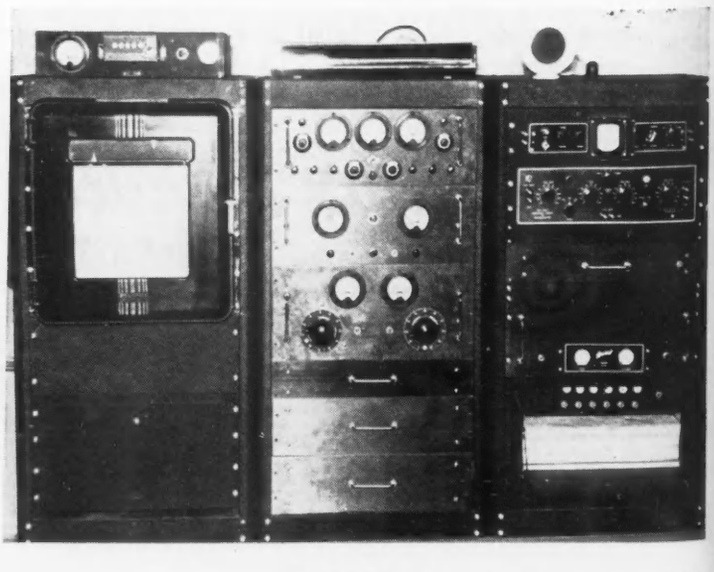


FIGURE 2 (left). A simple line drawing illustrating the main components of the simultaneous radiation log and subsurface instruments.

FIGURE 3 (below). Front view of standard surface logging instruments used in conjunction with simultaneous logging.



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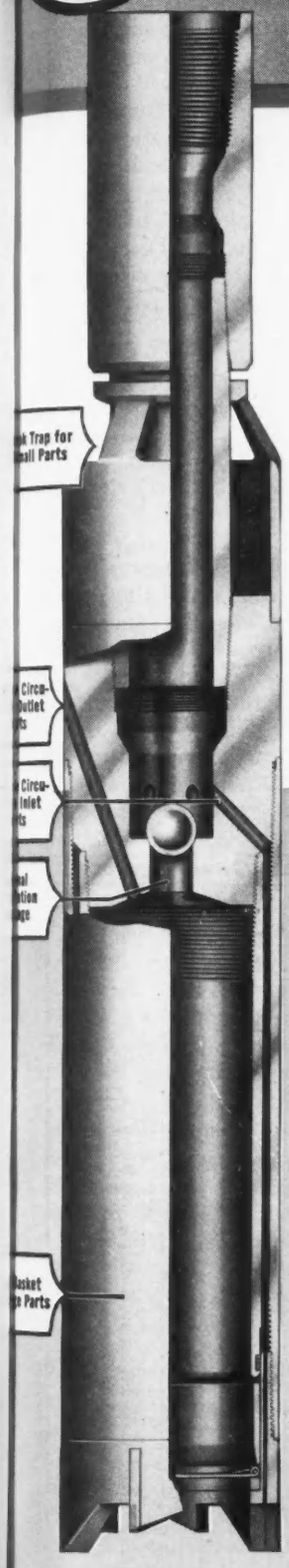

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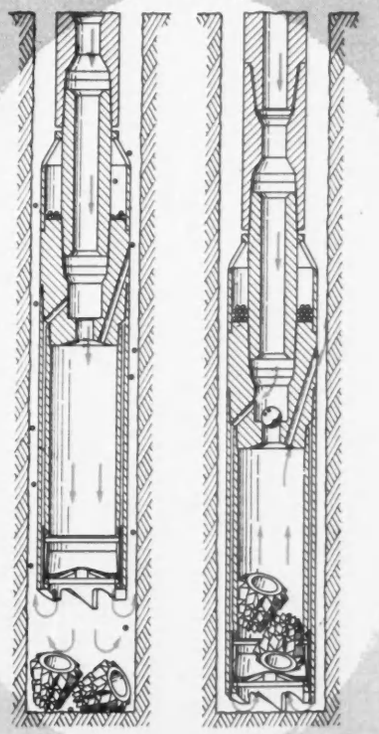

"A" "B".

Here's how it works . . .

The diagram "A" shows the tool as it is run into the well. As the bottom of the hole is approached, circulation is established in the normal way, thus picking up all small pieces of junk and circulating them up around and above the tool with the mud stream. The higher fluid velocity around the body of the tool carries the small junk upward above the junk basket. At this point the drop in fluid velocity (due to greater circulation area) permits the pieces to fall back into the junk trap in the top of the tool where they are held against further movement or circulation. To aid this recovery action, the pumps should be stopped at intervals to insure all the small pieces being dropped out of the fluid stream.

After the small parts and pieces have been cleaned out of the hole and trapped where they cannot interfere with recovering the larger parts, a ball is dropped down the drill string to close off the normal circulation passages and establish a *reverse circulation* flow as shown at "B". The full fluid flow then travels down through outer passages *to the very bottom of the tool* (not just part way down) where it jets *inwardly* against the larger pieces of junk, centering and washing them up into the main junk basket in the lower end of the tool.

With the fluid pressure thus jetting the pieces of junk into the center of the hole, the drill string is slowly rotated and lowered until all foreign material at the bottom of the hole has been stirred up and carried up into the basket, where it is retained by spring-actuated fingers.

The tool is then withdrawn—with the smaller pieces of junk held in the specially-designed junk trap from which they cannot escape, and the larger pieces firmly trapped in the main part of the tool. The entire recovery operation is simple, quick, *positive!*

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ADVANTAGES OF THE BAASH-ROSS COSTIN CONTROLLED CIRCULATION PRINCIPLE!

- Small pieces (bearings, small metal parts, etc.) are first cleaned from the hole by direct circulation, then are collected in a junk trap specially-designed for them—a trap with a solid bottom (no "fingers") from which they cannot "drop through" or interfere with subsequent recovery of the larger pieces.
- Larger pieces are washed up into the lower basket by reverse circulation, then are trapped in a separate basket specially-designed for holding these larger parts.
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- Amount of circulation in each direction is under full control of the operator, permitting extra emphasis on recovering small parts or large parts, as desired, depending upon nature of the junk in the hole.
- The entire operation is simple and positive. No new techniques or complicated manipulations to learn.

recording point of the detectors. Some might consider that the gamma ray being eight feet off the bottom would be a disadvantage, but in several hundred wells logged in Kansas the information has never been required. However, when the operator must have that information it is a very simple matter to exchange positions of the Geiger-Muller counter and neutron counter and thereby secure a gamma ray curve to within one foot of bottom. Normally, the bottom eight feet of an oil well is one geological formation, and the problem at hand is the determination of porosity within that formation. Therefore 99 percent of the wells logged demand that the neutron log reach bottom.

Figure 1 pictures a normal field setup of the two pieces of equipment employed in making a simultaneous radiation log of a well. The small panel truck houses all the surface equipment necessary for the recording of the three logs. The larger truck is a standard gun perforator unit, housing all equipment, including the hoist, necessary for complete service of the well; logging, perforating either with bullets or jets, setting drillable bridging plugs and other allied wire line services. The two truck setup permits maximum flexibility in that the well operator may use the same hoisting equipment for perforating as he has just used for logging his well.

Figure 3 is a full front view of a standard set of surface logging instruments now in use with the simultaneous system. As shown in the photograph, the well logging engineer is in constant control of each of the component parts of the logging system including a cathode-ray monitor and a completely visible record. The pen and ink recording on chart paper provides a visible record during the process of logging a well.

About the Author

V. J. MERCIER introduced radioactivity well logging to the Kansas area in the summer of 1943 while serving as a division engineer with Lane-Wells Company. Mercier has been continuously active in geophysics and well logging since 1935, and is at present Division Manager for Perforating Guns Atlas Corporation.

He is an active member of several technical and professional societies including AAPG, AIME, API, IPAA, KGS, KIOGA, and the Petroleum Club of Wichita. He is a past Chairman and Section Delegate of the Kansas Section, AIME, and was recently elected secretary-treasurer of the Mid-Continent District, American Petroleum Institute.

Mercier is credited with about 14 published technical articles and papers, including the chapter on radioactivity well logging in "Subsurface Geologic Methods" published by the Colorado School of Mines.

Interpretation of Simultaneous Logs

For the interpretation of the simultaneous radiation logs, the same basic rules apply as are used for radioactive logs recorded on individually recorded runs into the well.

As an example, Figure 4 illustrates a simultaneous radiation log on the right compared with a ionization chamber type log on the left, both

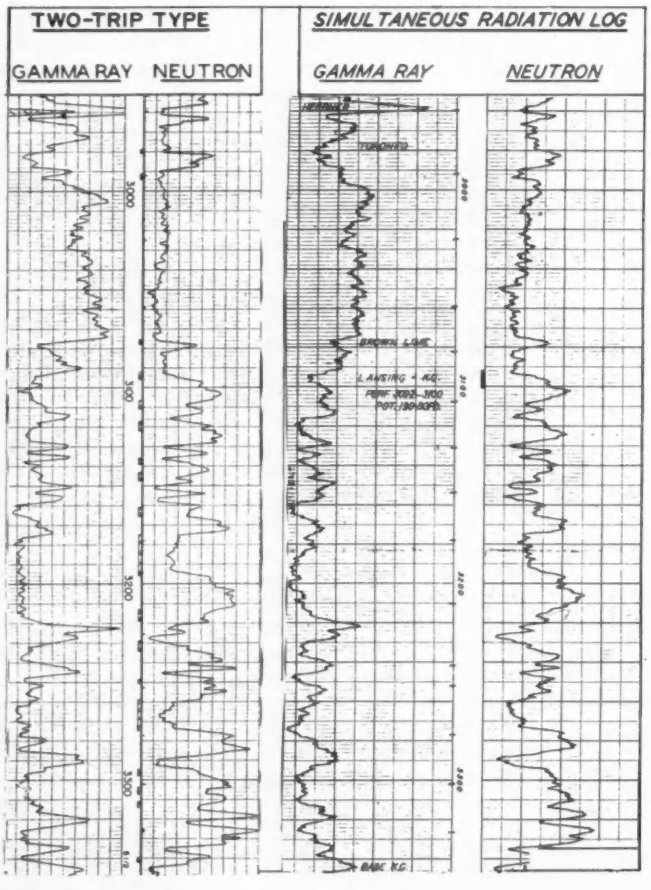


FIGURE 4 (left). Comparison of the simultaneous radiation log and the ionization chamber log. Each log was run in the same well. It will be noted that both logs have near-comparable responses to formation and fluid content.

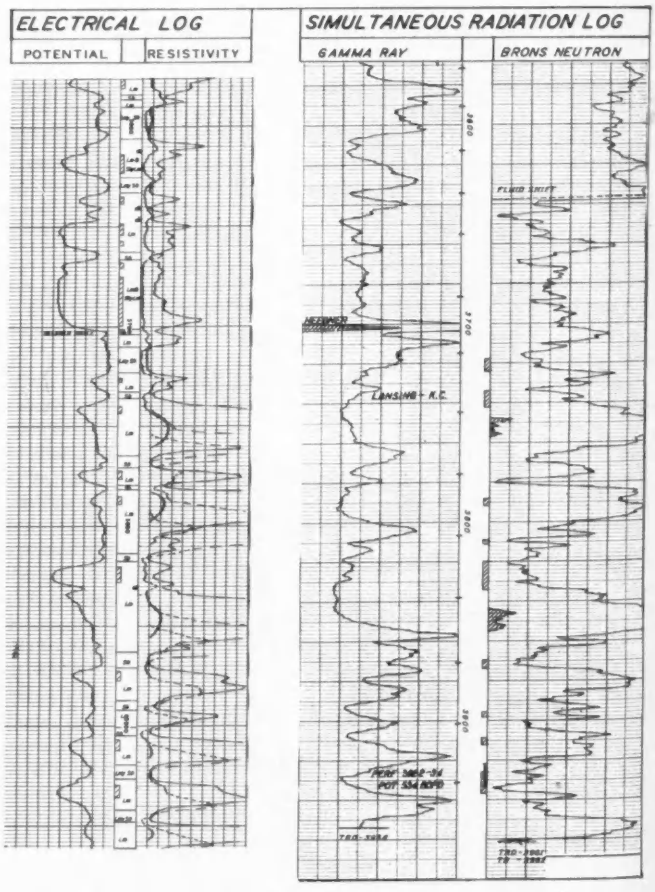


FIGURE 5 (right). Demonstration of the correlative possibilities of a simultaneous radiation and conventional electric log.

from the same well in Barton County, Kansas. It will be noted that both logs have an almost identical response to both formation and fluid content. In this instance, the simultaneous radiation log is printed directly from the original field recording.

Prints obtained from the original field recording preserve all of the characteristics, as can be seen on the simultaneous radiation log. This is highly important, for even minute deviations in either one of the logs is vital to proper and accurate log interpretation or quantitative evaluation.

This particular well was perforated from 3092 to 3100 feet, resulting in a potential of 190 barrels per day.

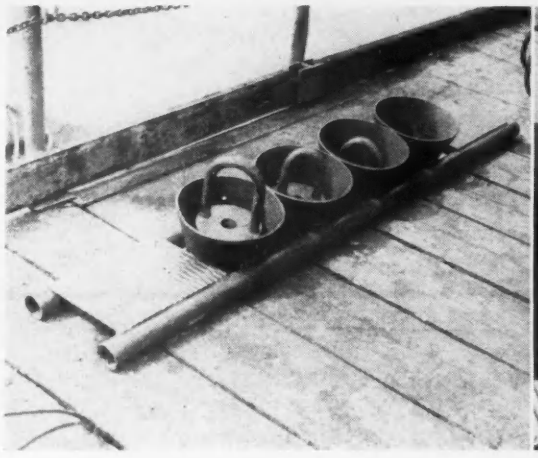
In Figure 5, the correlative possibilities of a simultaneous radiation log and a conventional electrical log is shown. This well, a wildcat in northwestern Kansas, was logged electrically before being cased in freshly mixed fluid replacing the salty mud. After casing was set and cemented the simultaneous radiation log was run. The main features of the spontaneous potential as compared to the gamma ray log and the normal resistivity as compared to the Brons neutron are easily readable.

Amazingly, enough there is only a two-foot difference in well measurements between these two logs although the surveys were run under entirely different conditions.

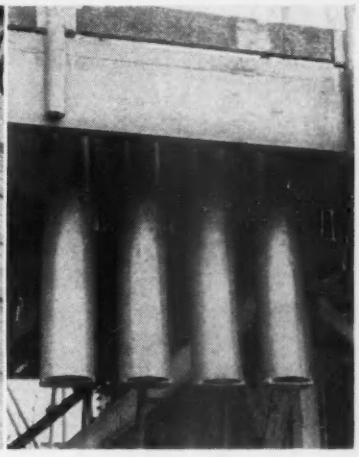
Considering this minor depth measurement difference, the porous zones interpreted from either log are confirmed by the other. No attempt is made to differentiate oil and water on radioactive logs, but under ideal conditions an electrical log can be analyzed to some extent.

Conclusions

It may be safely stated, from the experience thus far gained, that the simultaneous radiation log fills a much needed requirement in Kansas fields. The speed of operation by recording all logs simultaneously results in substantial savings in time on either rotary or cable tools. The promise of a calibrated neutron scale will greatly aid quantitative interpretations of the porosity. The past year's experience in logging several hundred Kansas wells definitely proves the value of the tool, demonstrating also that simultaneous radiation logs are free from interference between curves.



LEFT. Pockets for four sizes of subs are built into a substantial frame which is placed in a floor opening at the rig.



RIGHT. Barrels of the sub pockets hang down through derrick floor without hindrance to men working at the well.

Storage Pockets for Subs

Subs, like many other tools on the derrick floor, are usually stored at the side of the rig where they can easily be on the bottom of a pile of other material. A delay of several minutes to an hour, perhaps, is encountered before the required sub can be cleaned up and put in position of immediate use. One major operator decided that the place for subs would be in a specially prepared receiver which might be placed near the driller so the hook on the catline could be inserted in the ring for lifting. This would save considerable time, as well as protect the equipment. A number of different apparatuses were tentatively designed before the toolpusher conceived the idea of building sub pockets of pipe nipples. The result was a nest of four pockets which could receive and contain four different sizes of subs or any combination of these tools which might be required at the drilling rig.

These pockets are made of reasonably smooth pipe so that the appearance of the rig can be maintained, and so that rough edges and joints do not be exposed to damage clothing or equipment when the nest of containers is lifted and handled for shipment or installation. The lower ends of the pockets are cut with smooth edges so that a substantial piece of flat steel can be welded across the opening. This flat bar is not so wide as the opening of the pocket so that drain holes are provided to release rainfall, and to drain water from the equipment when cleaning the floor with the derrick hose.

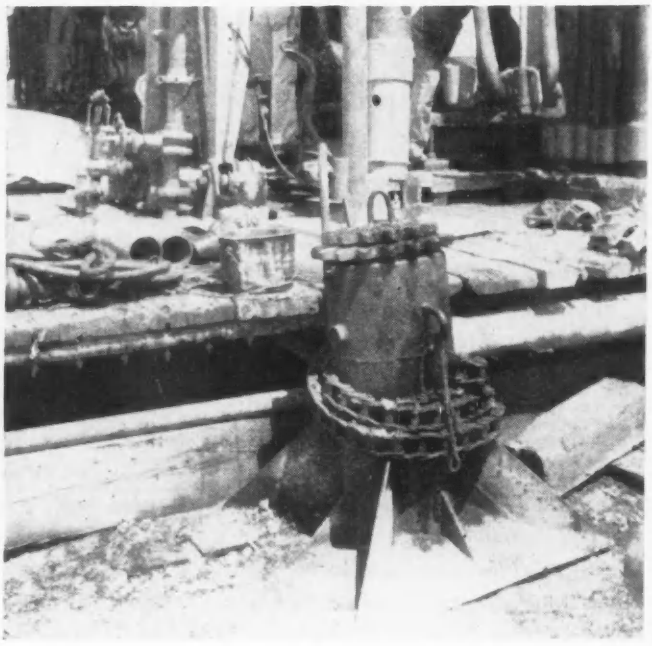
A two-inch pipe frame is provided so that a two-inch pipe is on each side of the nest to be welded on both sides of the retainers. Below the floor level, webs are attached between each adjacent pocket for welding it in a solid unit to provide a greater degree of safety when moving. The two-inch pipe is long enough to extend perhaps two feet beyond the nest of pockets so a flat piece of stairway tread steel can be permanently attached by welding. Treadstock is used rather than tank steel, to provide a rough surface which prevents men from slipping when walking across the unit with wet shoes. The top end of each pocket is finished with a belled extension flared out so the sub can be lowered into its resting place without a great deal of attention by the men working on the floor of the rig. The flooring of the rig is sawed with a slot just large enough to allow the assembled unit of pockets to pass through and be supported in place without additional reinforcement on the floor.

DRILLING HINTS

$10 is paid for each illustrated acceptable contribution. Mail to The Editor, WORLD OIL, P. O. Box 2608, Houston 1, Texas

HOW TO—Build Lightweight Device to Drill Ratholes

A shop-made device made of scrap sprockets, chain, pipe and sheet steel will speed the job of drilling the rathole. Normally, the rotary table is used to drill the rathole. This procedure requires maneuvering and angle blocking heavy equipment by means of the rotary line. In contrast, the light-weight rathole drilling device can be spotted on location with a light truck and left in position until the operation is completed.



Construction involves welding an obsolete casing head or heavy duty casing nipple to a base plate of heavy gauge sheet steel. Maximum rigidity is insured by welding several plate metal supports around the casing segment or head. One-inch metal rod loops are stationed on the outer shell of the unit to permit secure anchoring to the derrick floor with wire line or chain.

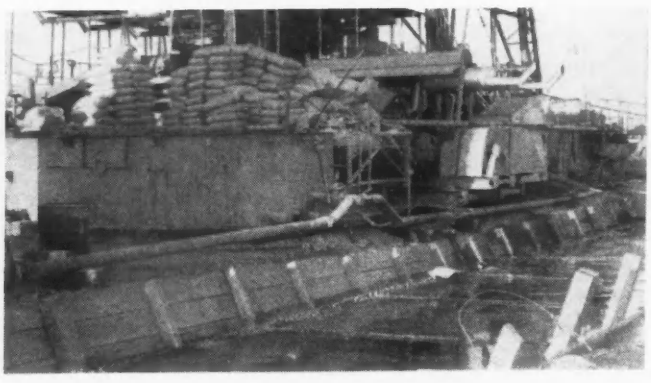
A pipe sleeve insert with a discarded sprocket retainer provides the rotating mechanism. The sleeve rotates within the outer shell by means of power transmitted from the rotary table, through a chain, to the sprocket atop the rathole drilling device. The protruding sprocket eliminates the possibility of the sleeve slipping down within the outer shell.

The illustration shows the small sprocket, which fits in the rotary master bushing, stored inside the drilling device sprocket.

In shallow well drilling where the rig is often moved, the nominal expense of this device is soon absorbed by more rapid rig-up time.

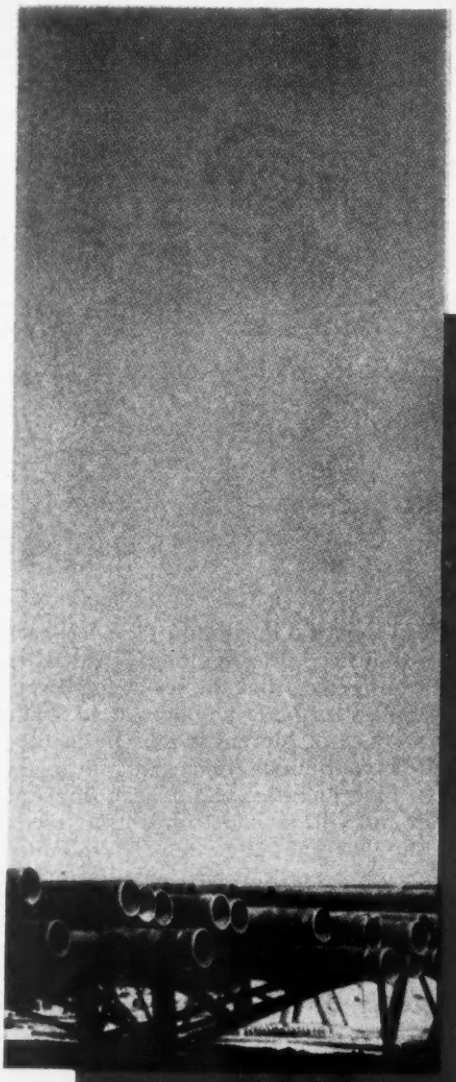
HOW TO—Switch to Reserve Mud Tank in Emergency

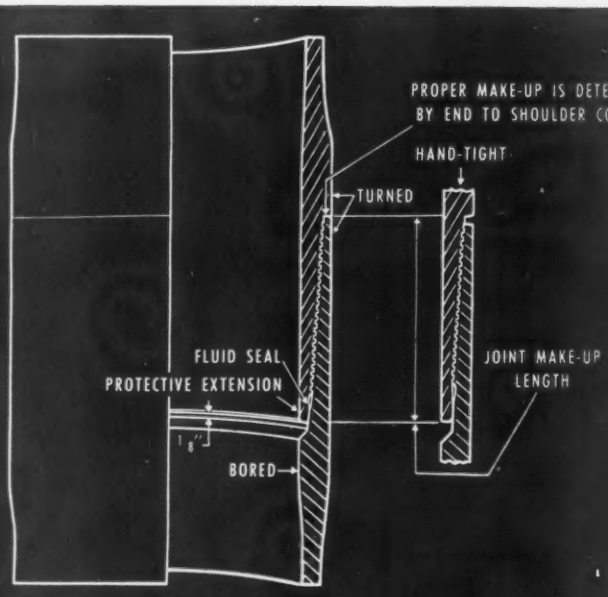
When problem formations are to be penetrated and a quick complete change of mud is necessary, the changeover can be made by closing one gate and opening another.



The steel pump suction pit is equipped with an end outlet for the line to the mud pump. The storage tank is placed nearby and filled with the type of mud necessary to control the anticipated formation. A line is laid between the outlet of the tank and connected to the conventional mud pit outlet with a common pipe line tee. A control gate on the outlet of the pit, and another on the outlet of the storage tank, provide the necessary opening or shut-off to enable the mud pump to make an instant change in the type mud circulated down the drill pipe.

No waste of mud results from this arrangement, as the mud pump transfers fluid from the conventional mud pit to the reserve tank until circulation has been continued for a time sufficient for the special mud to reach the surface.





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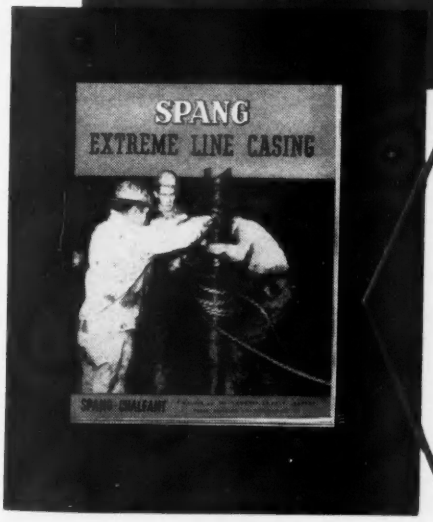

Eight reasons why it pays to use Spang Extreme Line Casing are detailed in Bulletin 352. Write for your copy, or check for details at your National Supply Store.

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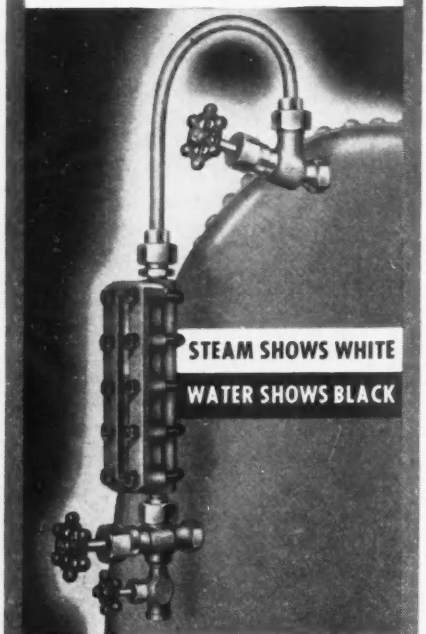

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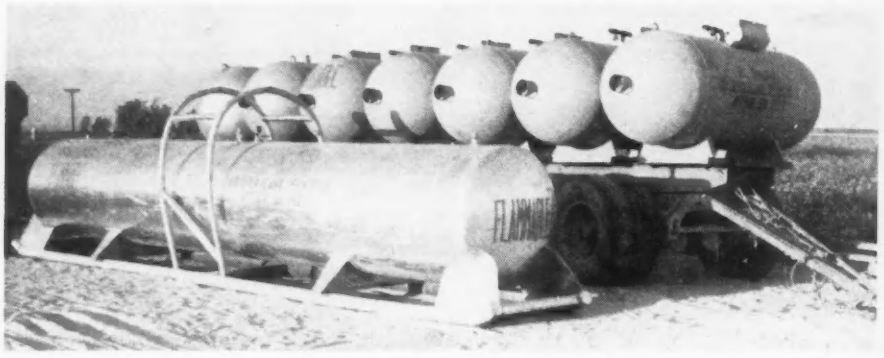
HOW TO—Maintain Sufficient Fuel



When a drilling well is isolated from natural gas for fuel, butane tanks can be arranged so an adequate supply can be kept available between runs with a transport trailer.

The large horizontal fuel tank is set near the rig and conventional fittings are attached to withdraw the butane while other fittings admit a fresh supply from a mobile unit. This mobile unit contains seven vessels which can be drawn upon for fuel, but may also be dumped into the large tank by equalizing lines.

When the horizontal tank has been exhausted, the remaining liquid is transferred from the seven small containers to the large one. An adequate amount of butane is thereby assured for continuous operation until the trailer mounted tanks can make a round trip to and from the source of supply. The large tank is mounted on skids and has the added safety of crash rings to protect the fittings if an accidental roll should be encountered when loading or unloading the tank.

HOW TO—Anchor Derrick Standpipe

Setting the standpipe in the derrick becomes a routine operation when standard footings are installed on the bottom sill of the substructure.

The footing is made by trimming a convenient length of structural steel to fit into the channel of the substructure sill and welding it permanently in place. The top flange of the I-beam is trimmed with a circular cut to eliminate a potential safety hazard.

A heavy steel cup is then welded to the flange near the end of the support into which the end of the standpipe is inserted. This end of the standpipe is completed as if a swage nipple had been attached, with the small end exactly fitting into the cup on the bracket.

Each standpipe is always the same distance from the next, so the hydraulic line from the mud pump header can be laid-out and union connections made each time the string is rigged up.

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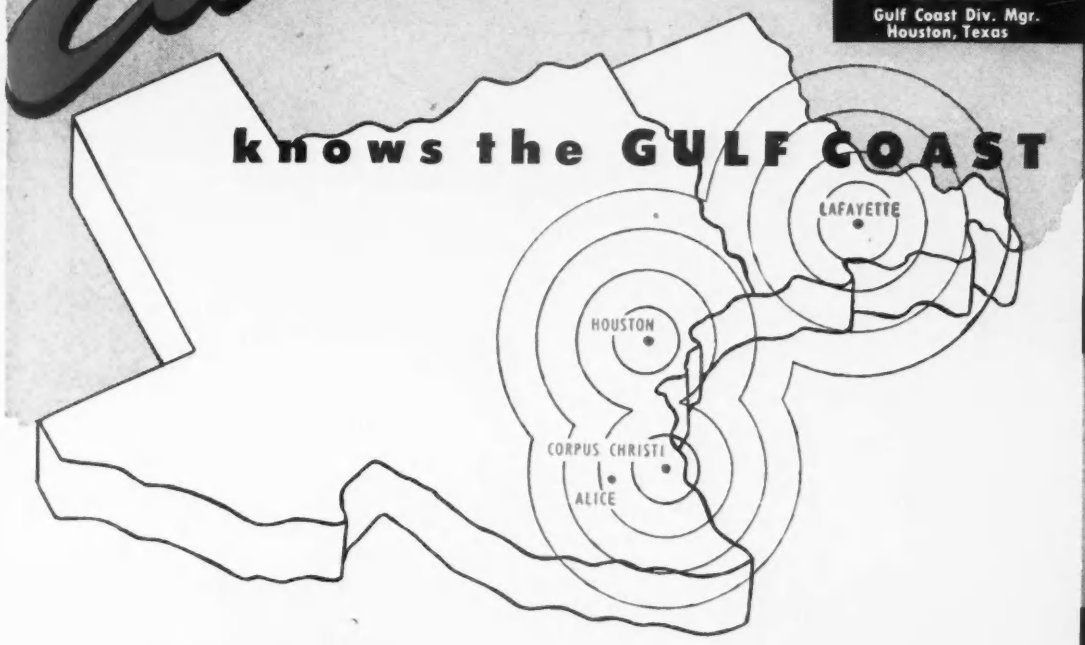

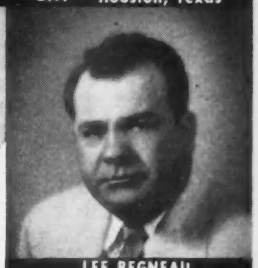

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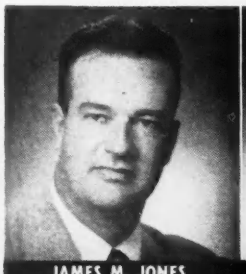

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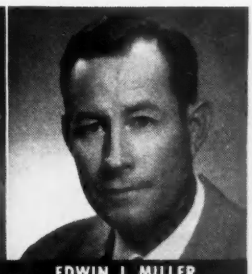

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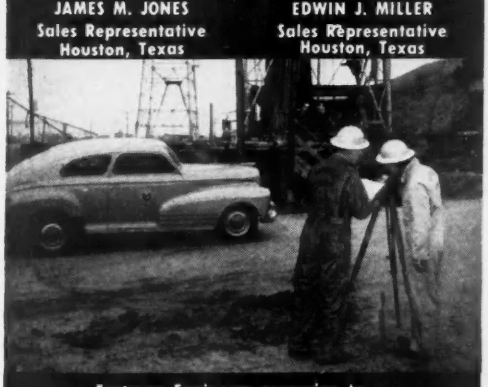

Eastman Engineers preparing to run a Multiple Shot Survey

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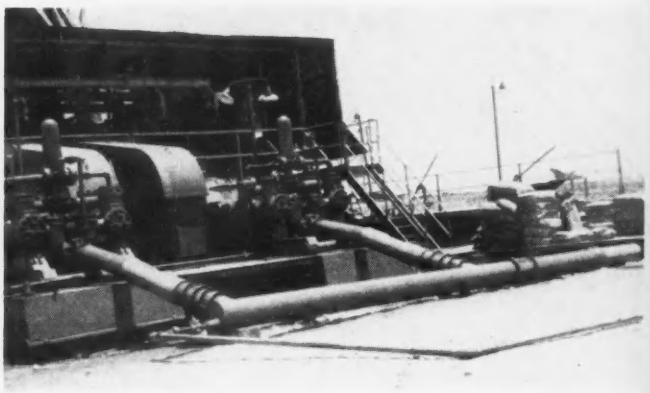
HOW TO—Manifold Pump Suction



Rig-up time can be substantially reduced by installing a common suction line on mud pumps. The application offers definite advantage when the mud system is above ground. In this manner, the pump suction is charged by the fluid head in the tank. Experience dictates that field application of the community suction line should be avoided in the case of pits below ground level unless a charge pump is pressed in service.

A prerequisite of the successful common suction system is utilization of pipe with a diameter sufficiently large to reduce the occurrence of compounded friction losses. In practice, the suction trunk must be of a larger diameter than the lines extending from the pumps. Hence, selection of line sizes will be governed by flange connections on the mud end.

At the mud end of the pump is flanged a pipe nipple sufficiently long to extend over the unit skid. At this point, a short section of rubber suction hose is sleeved on the pipe nipple to insure adequate flexibility and to erase the possibility of vibration transmission through the line. The void between the rubber hose and common suction trunk is junctioned by means of short pipe segments and expanding sleeves.

Construction of the common suction trunk involves plate blocking one end of the big inch pipe. Near this blind end, a window is cut in the side to accommodate the suction lead line extending from the mud pump. The same operation is completed adjacent to the remaining pump powered from the rig compound. Comparable connections are used on each pump junction line connected to the common suction trunk.

For ease of transport, additional expansion sleeves are at strategic points along the trunk line. Flanged fittings join the trunk line and mud pumps to suction tank of circulating system.

Optional facilities in the system include a two-inch water line attached to the blind end of the suction trunk line. The line is swaged down to one inch and expanded back to two inches at the point of entry. In this manner, a slight jetting action effectively blends water with the drilling fluid. Control of the water flow is regulated by a one-inch lubricated plug valve.

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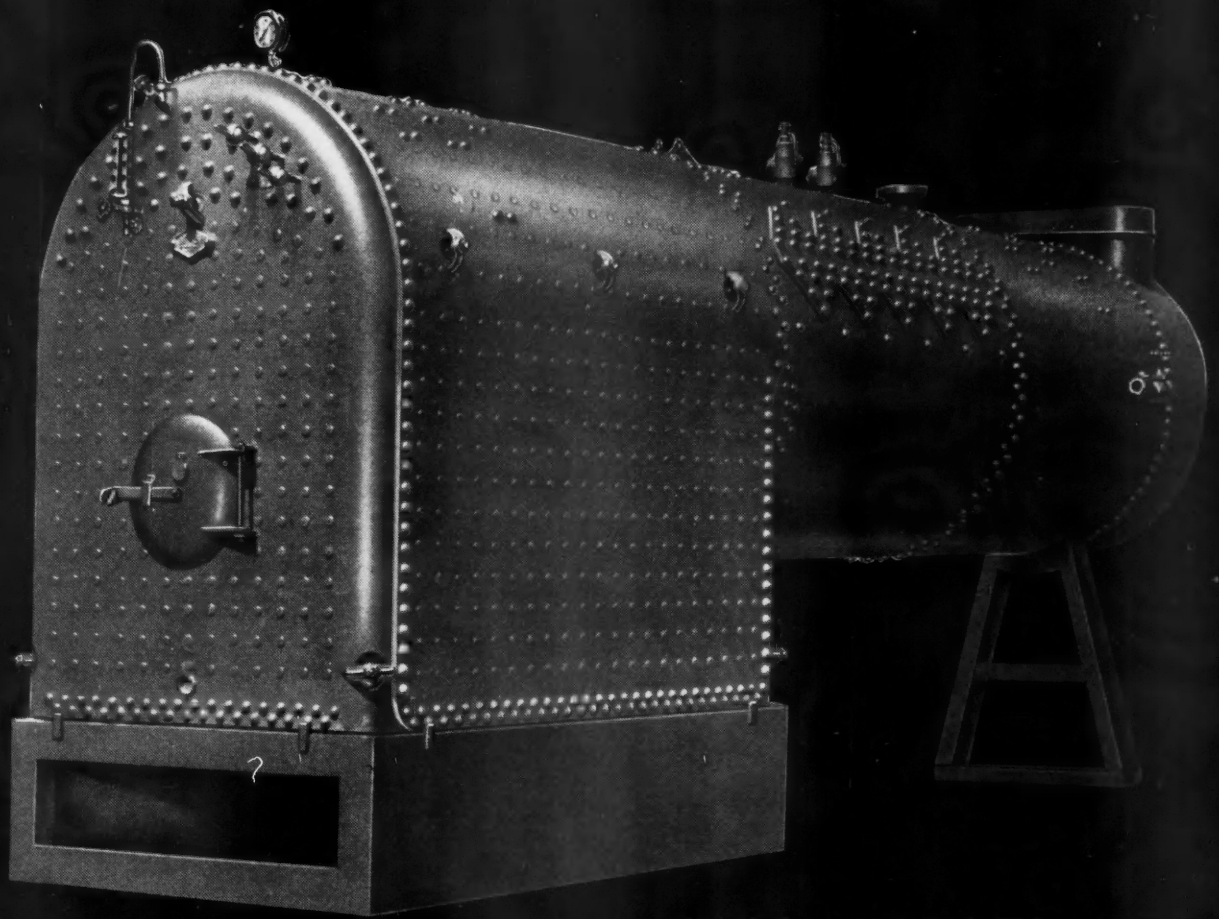

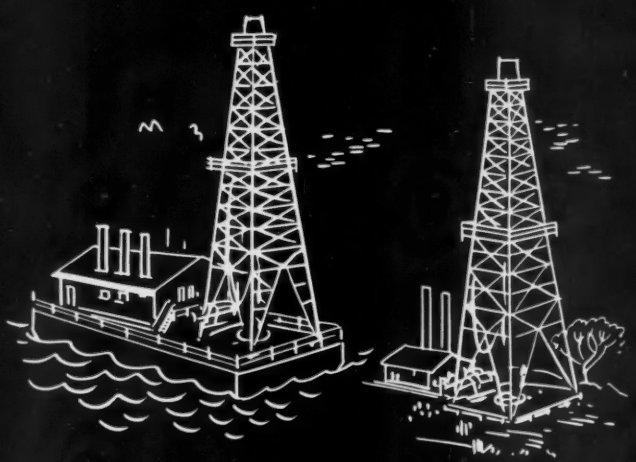

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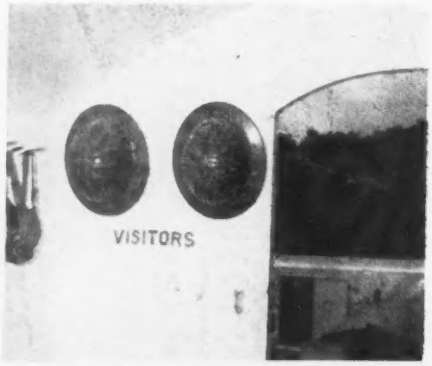
HOW TO—

Safeguard Visitors From Injury on Rig



Reserving two extra hard hats for the exclusive use of visitors who may visit the rig is the practical and worthwhile practice of a company operating in the San Juan Basin of northwestern New Mexico.

The hard hats, painted a bright red and hung just inside the entrance to the dog house located beside the rig floor, not only afford protection to the visitors, but serve also to identify the visitors so that crew members can tell, at a glance, where they are and be assured they are not in the way of a catline, high line or other equipment where an injury might be sustained.

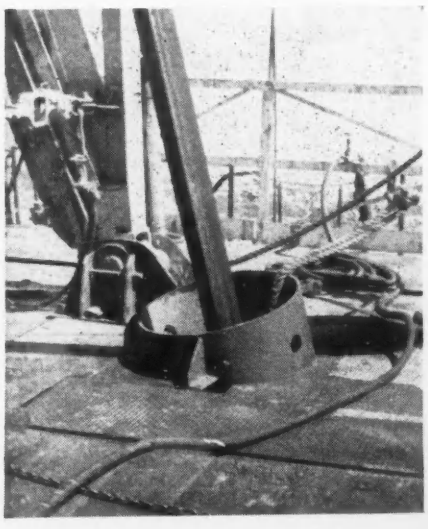
If the hats should be instrumental in preventing a bumped head or splatter of mud in the hair or face, they will have served their purpose. In addition, the practice in itself is a form of public relations inasmuch as the average visitor at a busy rig is appreciative of the courtesy afforded by the operator.

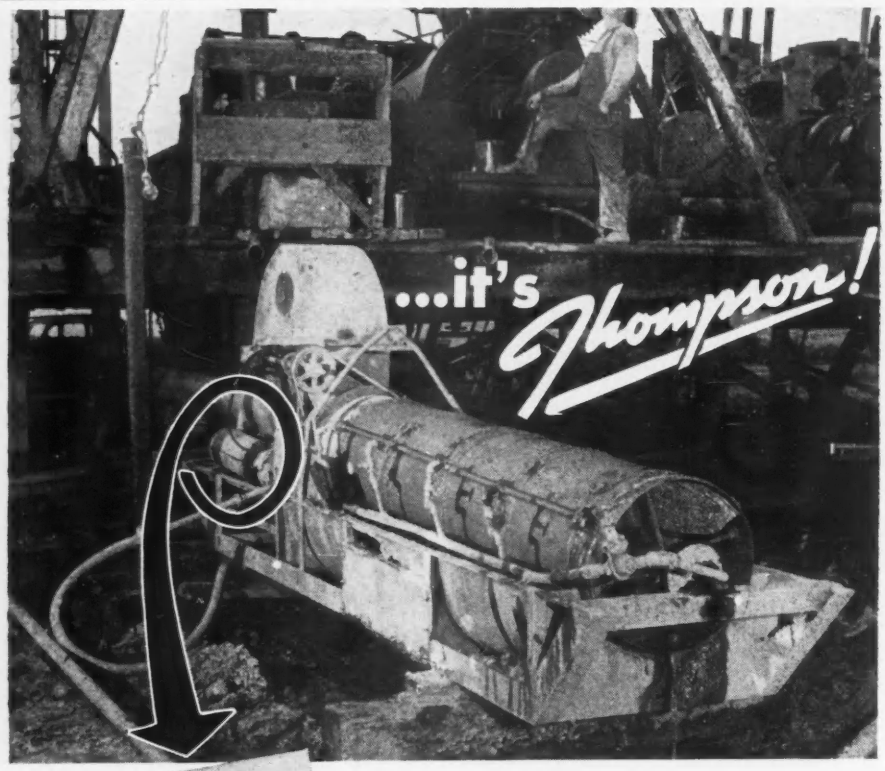
HOW TO—

Protect Kelly from Damage in Rathole

A rathole casing with a swaged top will prevent the pin end of the kelly from sinking into the muck and mud at the bottom of the hole. The kelly bushing rests on the small section of the swage to support the entire kelly above the bottom of the hole. This protects the threads from damage by contact with loose rocks or boulders in the soil, and keeps the pin clean enough that a stream of water from the rig hose will wash away any mud.

The casing illustrated is built with the top slightly above the floor, and rests on lugs bearing on steel plates in contact with the floor. When the rathole is not in use, it is roofed with a hinged manhole cover as a protection for the crew, and to prevent tools from falling into the casing.





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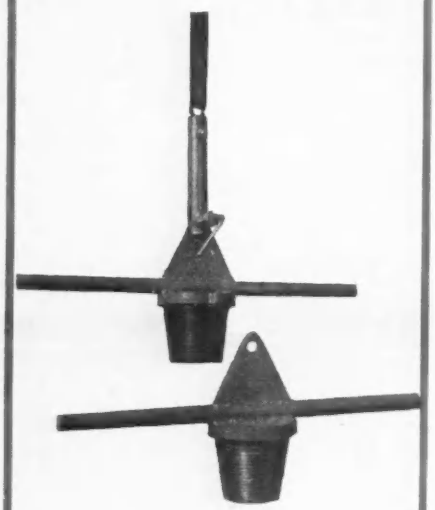

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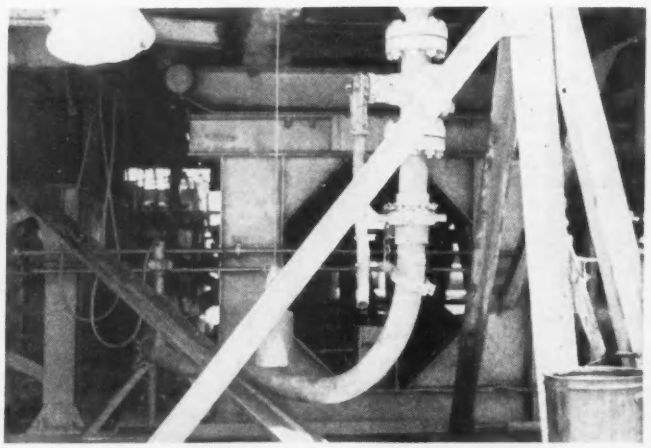
HOW TO—Streamline Pipe Hookup



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Hydraulic pipe is mounted on substantial hook-type brackets so that all of the mud lines are in place, except flanging up the discharge hose from the mud pumps. This hookup starts with a horizontal header fitted with connections for 1, 2 or 3 mud pumps, each connection equipped with lubricated plug valves and a set of ground joint unions that can be made up, or broken out with a ball peen hammer.

From the header, the mud line is laid inside the substructure with a drilling hose attached to the opposite end which leads to the derrick standpipe. By using this type of hookup, some valuable rigging time is saved, and the over-all down time is materially shortened.

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the valve, it discharges harmlessly into the pit until pressure on the line is reduced.

The change was accomplished simply by removing the ell with the relief connection from above the pump and placing it near the corner of the pit. The ell on the ground took the place of the one on the pump and no additional connections were necessary. A quick-acting union in the discharge line made the change possible within a few minutes.

This system avoids piping the discharge from the relief back to the pit, but it is necessary to make sure that no valves are placed between the relief valve and the mud pumps.

HOW TO—Circulate Treated Water

Treated water is convenient on a drilling rig for use in engines, to prepare solutions of mud additives, and for the men to wash out soiled over-alls, gloves and the like. The treating unit beside the derrick is equipped with a circulating pump to backwash the bed of green sand and to reactivate with salt water. In the manifold of this pump is another discharge line which leads to a small manifold beside the storage tank so that separate pipe lines can be run to various parts of the rig where soft water is required.

The manifold is made in two similar sections with a ground joint union to join the two when the unit is in service. Each section is set on triangular sheet steel supports, which are welded to the horizontal main line of the manifold and to flat pads to support the parts on soft ground. Unions are set into each line and placed as closely to the manifold as practicable so that tearing down and rigging up can be done quickly by one man.

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J. E. KASTROP, SECTION EDITOR

WORLD OIL

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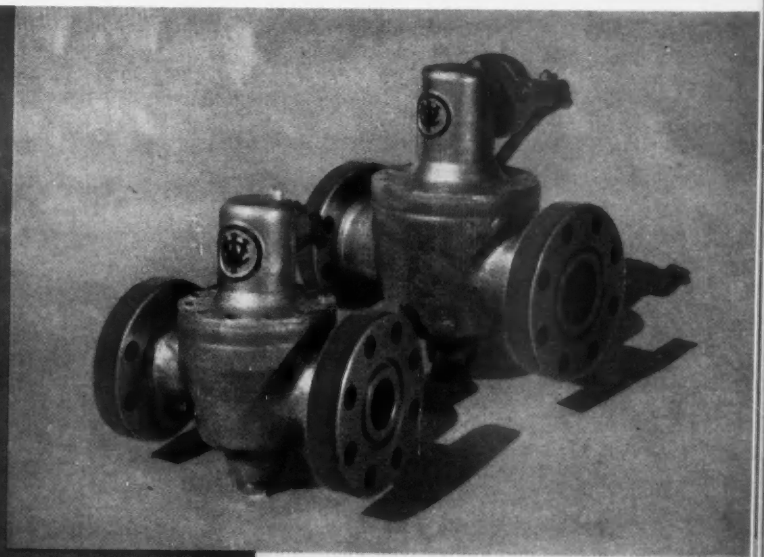
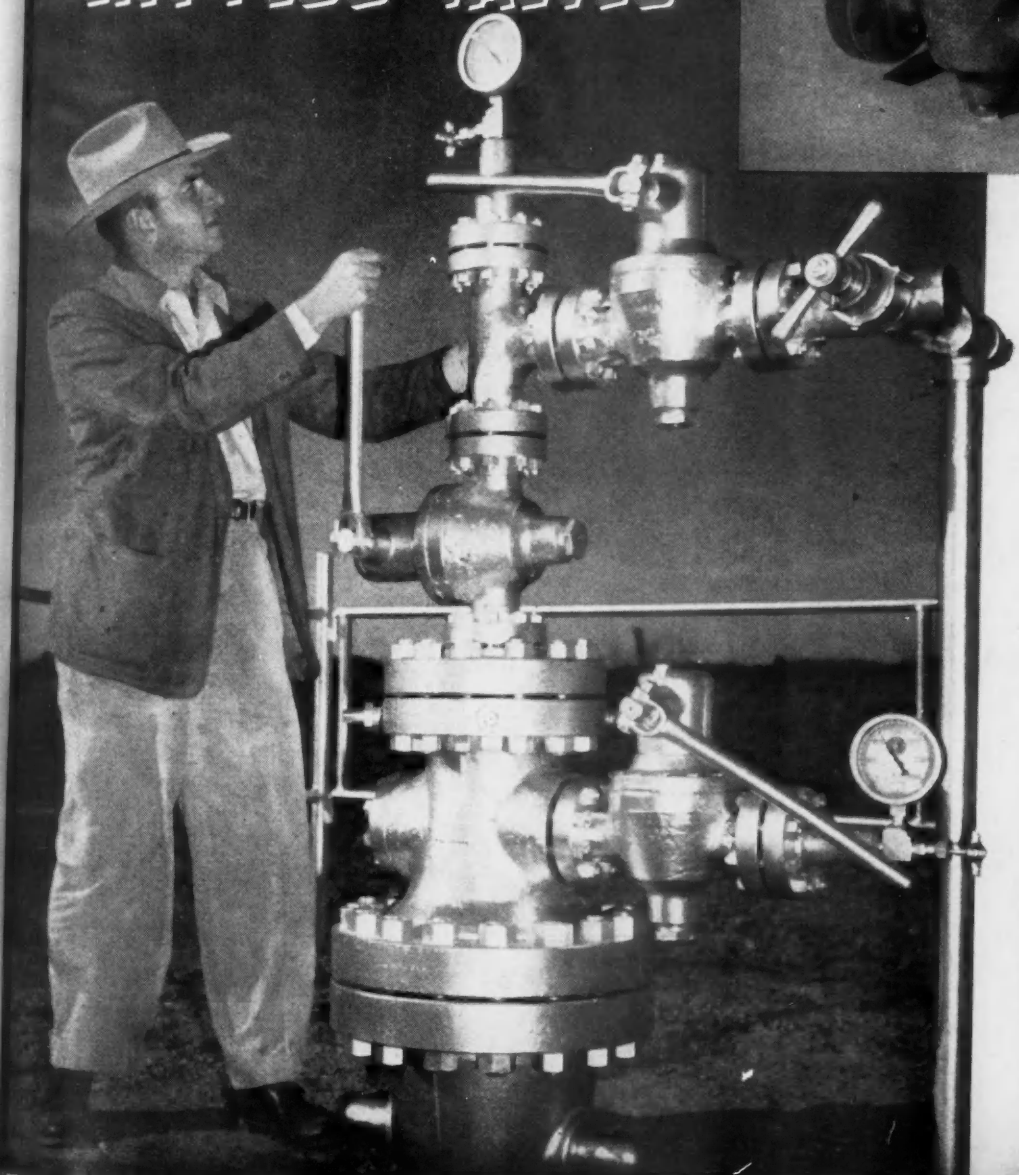
NON-LUBRICATED

LIFT-PLUG VALVES





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FOUR—RENEWABLE SEAT AND PLUG—easily replaced; permits any desired trim for specific services.

FIVE—REPAIRS ON THE JOB—can be completely overhauled without removal from line; no special tools or skill required.

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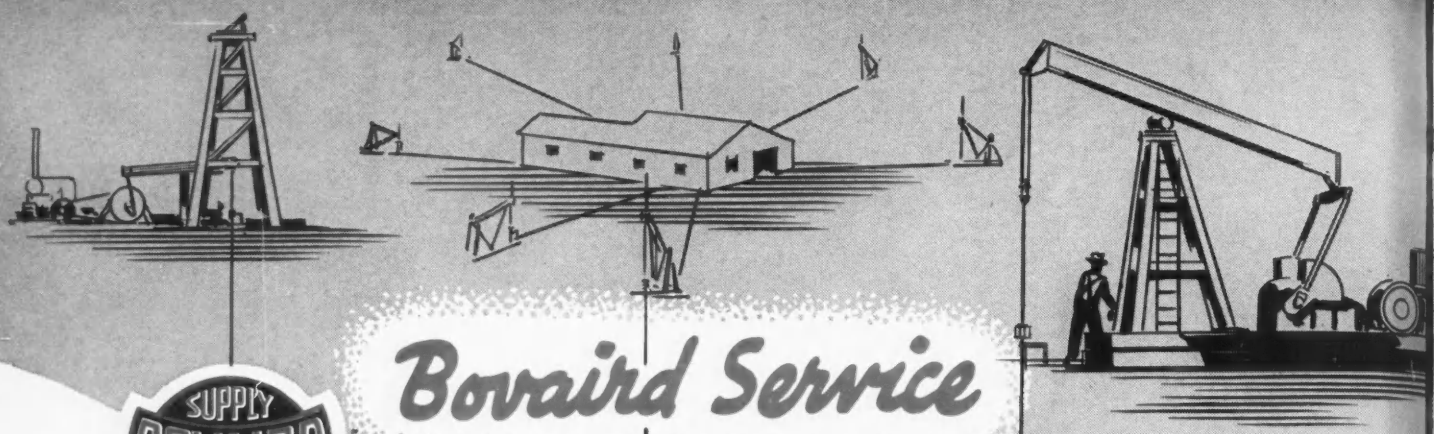

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80 YEARS OF PROGRESS WITH THE OIL INDUSTRY

Heat Losses from Buried Gas Gathering Lines

By J. T. SIMON
Chief Petroleum Engineer
Mountain Fuel Supply Company, Rock Springs, Wyo.

THE AUTHOR outlines methods for securing actual temperature data on a gathering system to check assumed values of heat loss to soil. Such data are valuable in designing equipment for preheating gas to insure against formation of hydrates between wellhead and centralized dehydration plant. Intermediate heaters, placed in accordance with experimentally obtained data, eliminates need for auxiliary equipment.

THE effect of pressure and temperature on the formation of hydrates in natural gas pipe lines is well known. As indicated from published curves, the higher the pipe line pressure the higher will be the temperature at which gas hydrates will begin to form.

For a given operating pressure in the pipe line, if the temperature of the flowing gas can be maintained above the expected hydrate formation temperature, no hydrates will accumulate. This can be done by the installation of heaters at successive intervals along the pipe line to maintain the temperature of the flowing gas. Where large volumes of gas are to be transported long distances, this is not practical because of the fuel requirements for the heaters and the rapid loss of heat from the flowing gas to the surrounding ground. Gas dehydration becomes a must under these conditions; however, in some fields the gathering systems may be so extensive that hydrates may form before the gas reaches the dehydration plant. Under these conditions, well heaters or intermediate heaters to keep the flowing gas temperature above the hydrate temperature are justified.

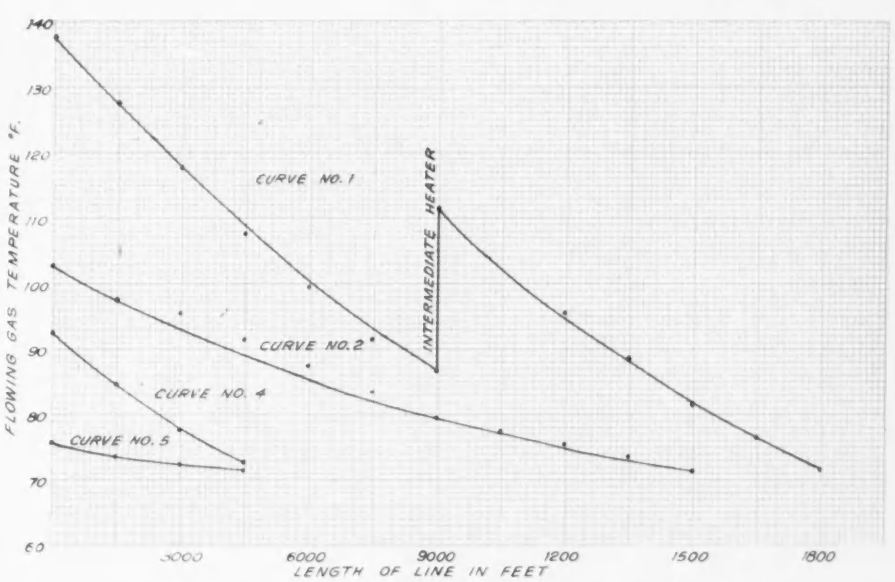
Gas production from the Church Buttes field required that a low-water, low-hydrocarbon dewpoint gas be made available for the gas transmission line. Since well pressures were high and plant investment was to be kept at a minimum, it was decided to dehydrate the gas at approximately 1500 pounds per square inch, using a solid desiccant-type plant. After dehydration, the gas pressure is reduced to 400 psi and the natural cooling derived from the pressure drop causes condensation of the hydrocarbons which are removed from the gas stream by a horizontal oil and gas separator.

The necessity for dehydration at a high pressure raised the hydrate forming temperature of the gas upstream from the plant to slightly under 70° F. This developed the problem of determining in advance whether or not the gas could be flowed to a central dehydration plant with only the heat added by the heater located at the well. The most critical section seemed to be the four-inch line from Unit Well 2 to the dehydration plant, approximately 3.5 miles.

In determining this, the heat available in the gas must equal the heat lost to the ground for a given length and size of pipe. The heat available in the gas is:

$$VC_p\ (T_1 - T_2)$$

The heat lost to the ground is:



Temperature drop in gas gathering system, Church Buttes field.

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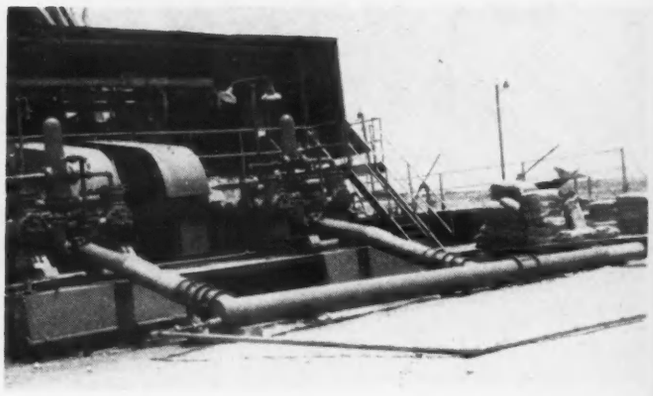
DRILLING HINTS

HOW TO—Manifold Pump Suction



Rig-up time can be substantially reduced by installing a common suction line on mud pumps. The application offers definite advantage when the mud system is above ground. In this manner, the pump suction is charged by the fluid head in the tank. Experience dictates that field application of the community suction line should be avoided in the case of pits below ground level unless a charge pump is pressed in service.

A prerequisite of the successful common suction system is utilization of pipe with a diameter sufficiently large to reduce the occurrence of compounded friction losses. In practice, the suction trunk must be of a larger diameter than the lines extending from the pumps. Hence, selection of line sizes will be governed by flange connections on the mud end.

At the mud end of the pump is flanged a pipe nipple sufficiently long to extend over the unit skid. At this point, a short section of rubber suction hose is sleeved on the pipe nipple to insure adequate flexibility and to erase the possibility of vibration transmission through the line. The void between the rubber hose and common suction trunk is junctioned by means of short pipe segments and expanding sleeves.

Construction of the common suction trunk involves plate blocking one end of the big inch pipe. Near this blind end, a window is cut in the side to accommodate the suction lead line extending from the mud pump. The same operation is completed adjacent to the remaining pump powered from the rig compound. Comparable connections are used on each pump junction line connected to the common suction trunk.

For ease of transport, additional expansion sleeves are at strategic points along the trunk line. Flanged fittings join the trunk line and mud pumps to suction tank of circulating system.

Optional facilities in the system include a two-inch water line attached to the blind end of the suction trunk line. The line is swaged down to one inch and expanded back to two inches at the point of entry. In this manner, a slight jetting action effectively blends water with the drilling fluid. Control of the water flow is regulated by a one-inch lubricated plug valve.

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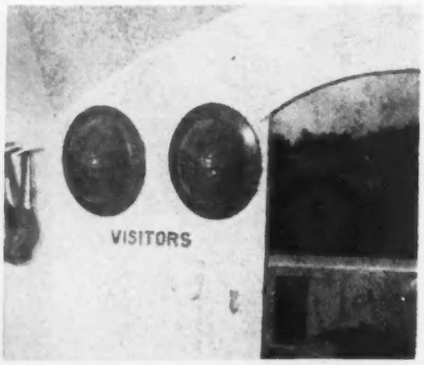
HOW TO—

Safeguard Visitors From Injury on Rig



Reserving two extra hard hats for the exclusive use of visitors who may visit the rig is the practical and worthwhile practice of a company operating in the San Juan Basin of northwestern New Mexico.

The hard hats, painted a bright red and hung just inside the entrance to the dog house located beside the rig floor, not only afford protection to the visitors, but serve also to identify the visitors so that crew members can tell, at a glance, where they are and be assured they are not in the way of a catline, high line or other equipment where an injury might be sustained.

If the hats should be instrumental in preventing a bumped head or splatter of mud in the hair or face, they will have served their purpose. In addition, the practice in itself is a form of public relations inasmuch as the average visitor at a busy rig is appreciative of the courtesy afforded by the operator.

HOW TO—

Protect Kelly from Damage in Rathole

A rathole casing with a swaged top will prevent the pin end of the kelly from sinking into the muck and mud at the bottom of the hole. The kelly bushing rests on the small section of the swage to support the entire kelly above the bottom of the hole. This protects the threads from damage by contact with loose rocks or boulders in the soil, and keeps the pin clean enough that a stream of water from the rig hose will wash away any mud.

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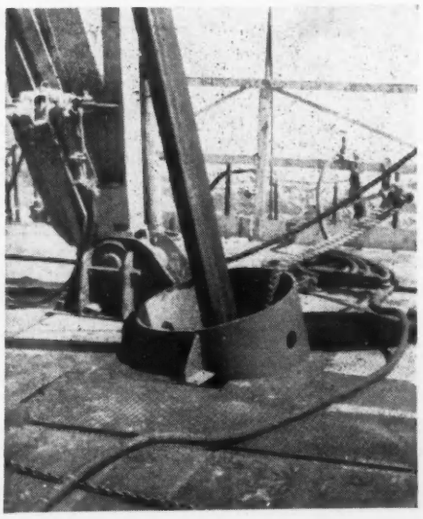

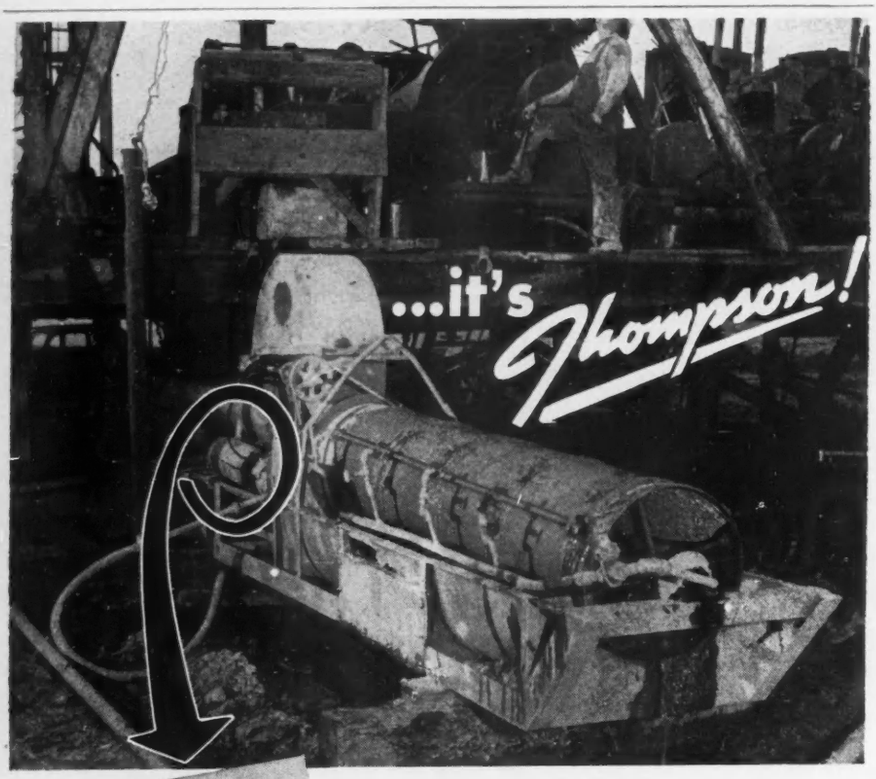

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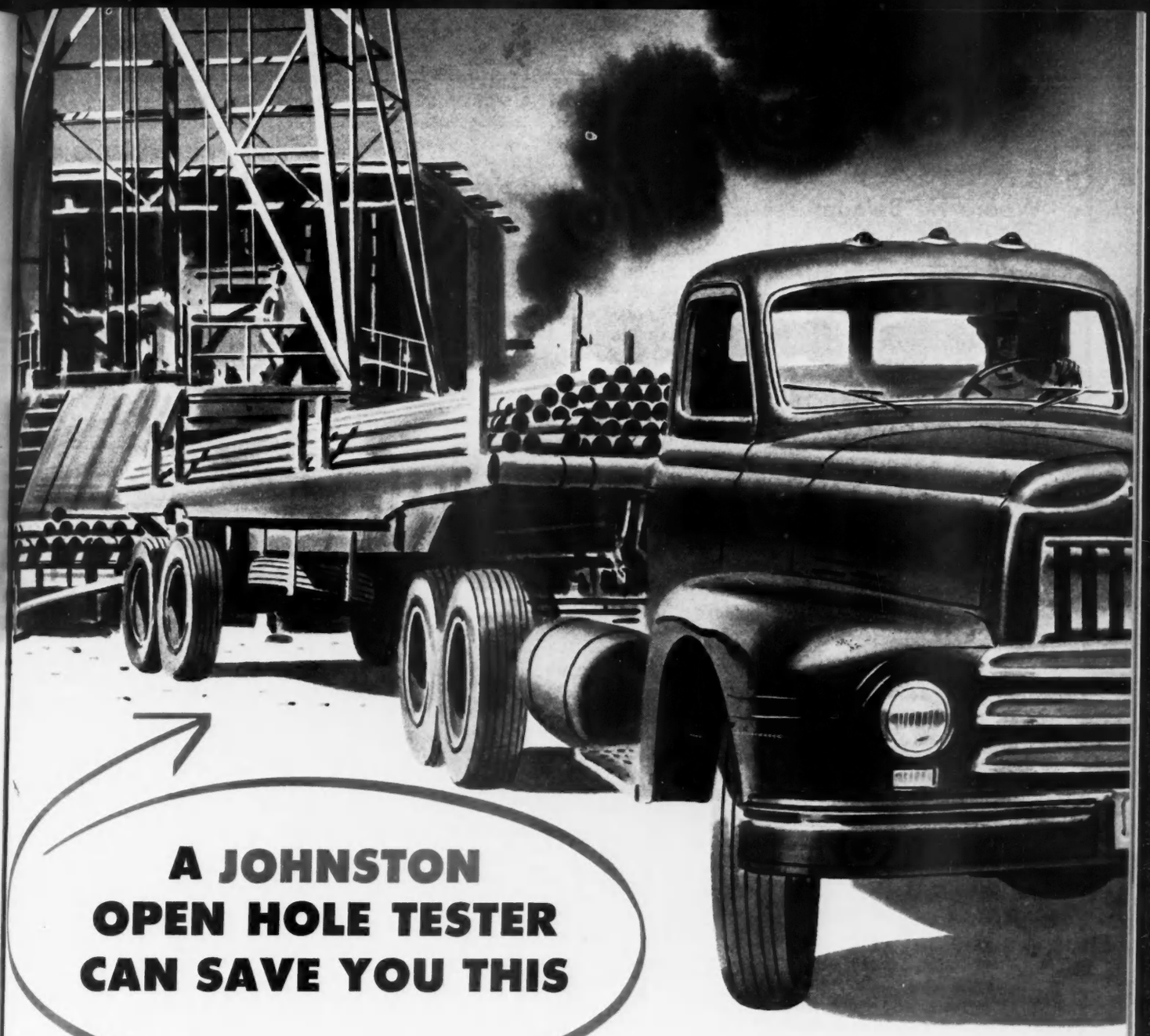

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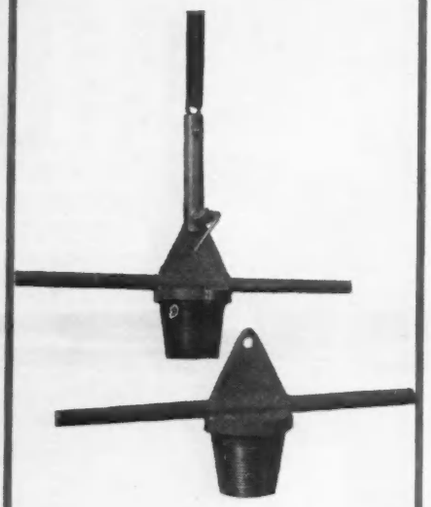

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Write for full particulars.

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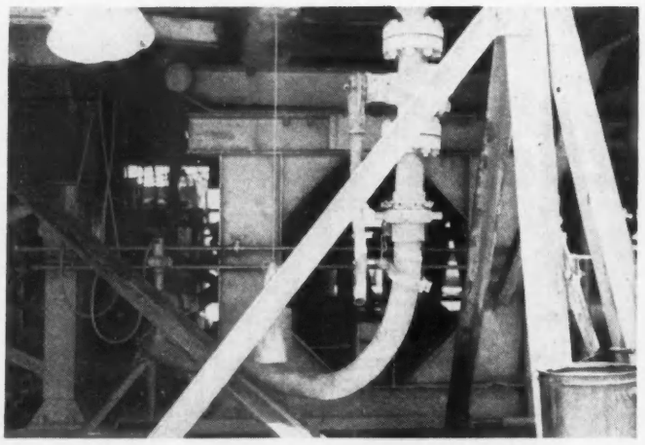
WICHITA FALLS, TEXAS

HOW TO—Streamline Pipe Hookup



When a drilling rig is designed for skidding, all essential equipment can be attached permanently to the substructure beneath the derrick.

Hydraulic pipe is mounted on substantial hook-type brackets so that all of the mud lines are in place, except flanging up the discharge hose from the mud pumps. This hookup starts with a horizontal header fitted with connections for 1, 2 or 3 mud pumps, each connection equipped with lubricated plug valves and a set of ground joint unions that can be made up, or broken out with a ball peen hammer.

From the header, the mud line is laid inside the substructure with a drilling hose attached to the opposite end which leads to the derrick standpipe. By using this type of hookup, some valuable rigging time is saved, and the over-all down time is materially shortened.

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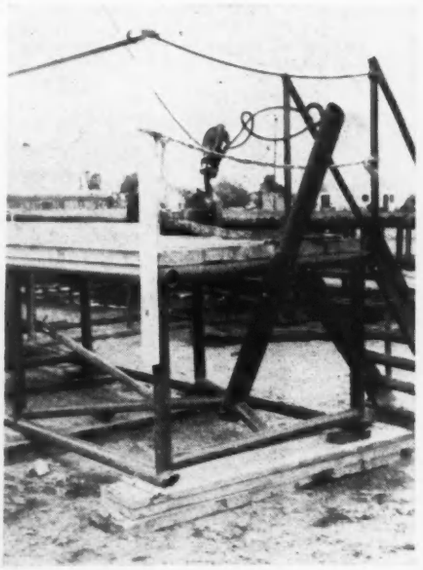
HOW TO—

Use Highline Post To Transfer Tools

An adjustable highline post which is an integral part of the rack walkway will expedite delivery of equipment from transport units to the derrick floor.

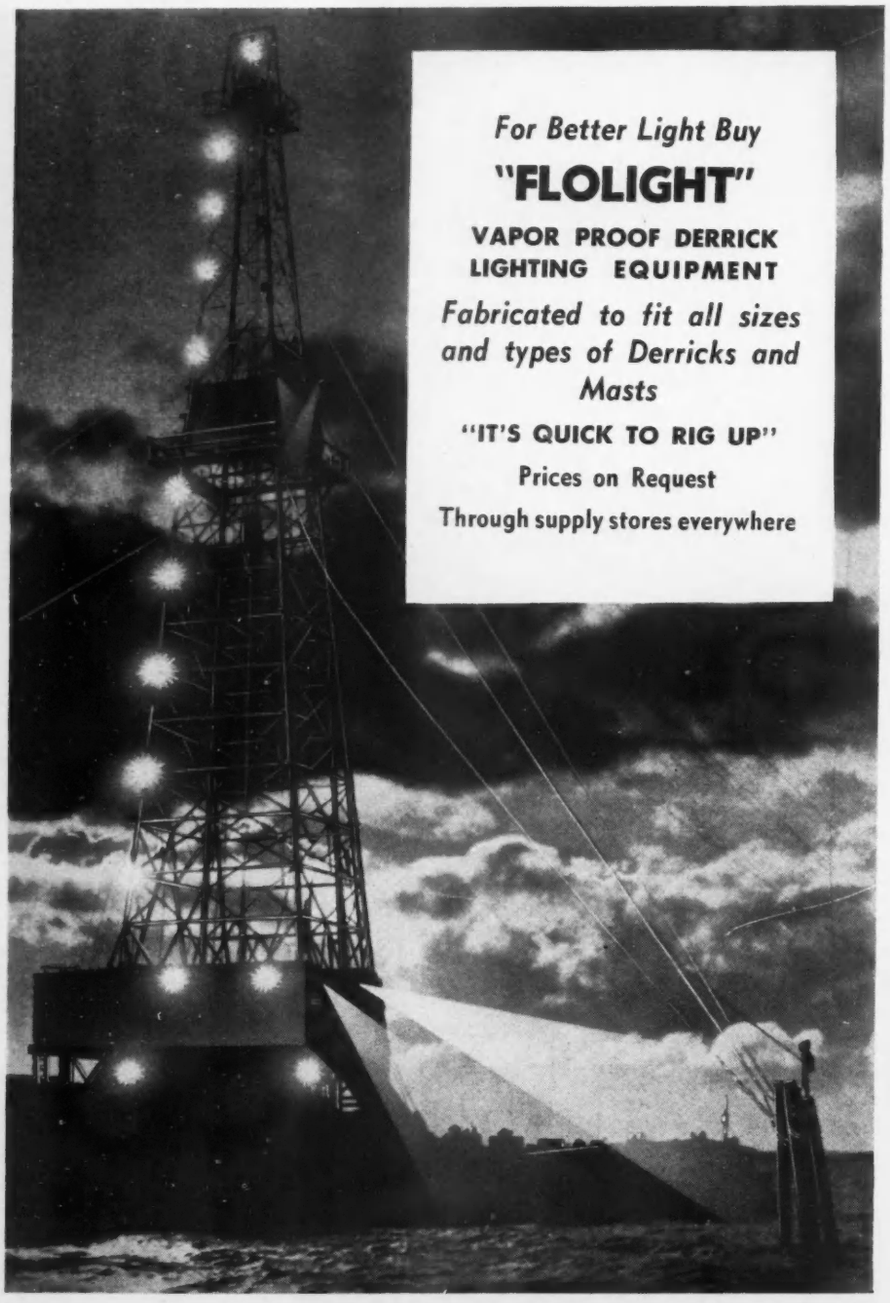
The highline post rests in a pipe socket tack welded and pipe reinforced to the base of the walkway. The apparatus is installed at an angle to insure the desired strength and eliminate the possibility of the unit's slipping from the socket when in use.

Height adjustment is possible by means of a pin and keyway arrngement. Keyways are cut through the pipe sleeve and post to accommodate a short section of one inch steel rod. With these facilities, the post can be



adjusted and secured at the desired height.

Aside from lending assistance in the process of moving heavy equipment from trucks to the floor, the unit can be used to transfer drill pipe or casing to or from the rig work area.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HOW TO—

Place Relief Valve To Protect Mud Pump

When a valve is closed in the mud line on the discharge side, the mud has to go somewhere and it is usually out the pop valve. After a contractor found his pumps covered with mud, he directed that the relief valve be placed near the ground and turned toward the mud pit. Now, if for any reason the mud is forced out through

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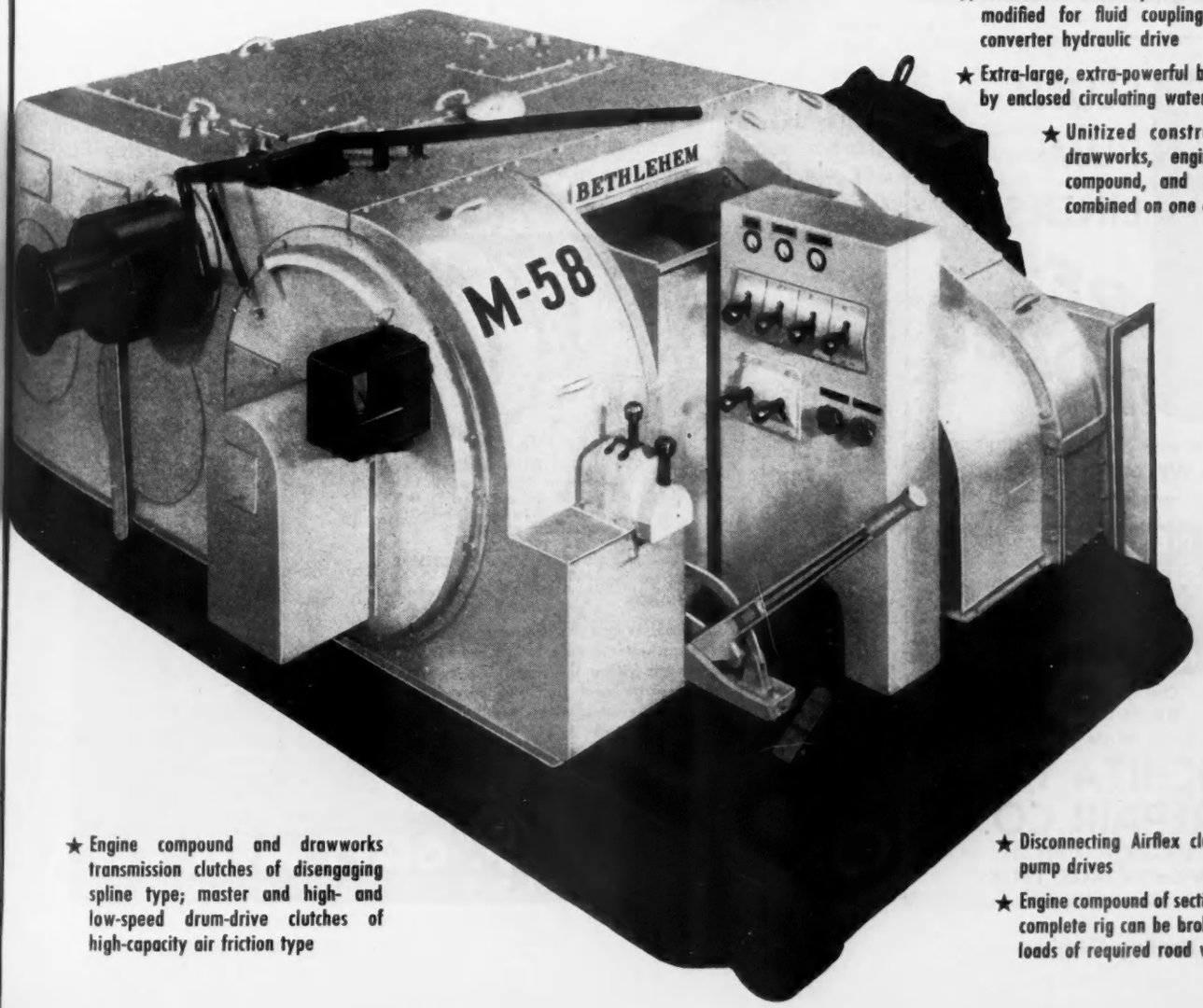

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★ Disconnecting Airflex clutch-controlled pump drives

★ Engine compound of sectionalized type; complete rig can be broken down into loads of required road width

the valve, it discharges harmlessly into the pit until pressure on the line is reduced.

The change was accomplished simply by removing the ell with the relief connection from above the pump and placing it near the corner of the pit. The ell on the ground took the place of the one on the pump and no additional connections were necessary. A quick-acting union in the discharge line made the change possible within a few minutes.

This system avoids piping the discharge from the relief back to the pit, but it is necessary to make sure that no valves are placed between the relief valve and the mud pumps.

HOW TO—Circulate Treated Water

Treated water is convenient on a drilling rig for use in engines, to prepare solutions of mud additives, and for the men to wash out soiled over-alls, gloves and the like. The treating unit beside the derrick is equipped with a circulating pump to backwash the bed of green sand and to reactivate with salt water. In the manifold of this pump is another discharge line which leads to a small manifold beside the storage tank so that separate pipe lines can be run to various parts of the rig where soft water is required.

The manifold is made in two similar sections with a ground joint union to join the two when the unit is in service. Each section is set on triangular sheet steel supports, which are welded to the horizontal main line of the manifold and to flat pads to support the parts on soft ground. Unions are set into each line and placed as closely to the manifold as practicable so that tearing down and rigging up can be done quickly by one man.

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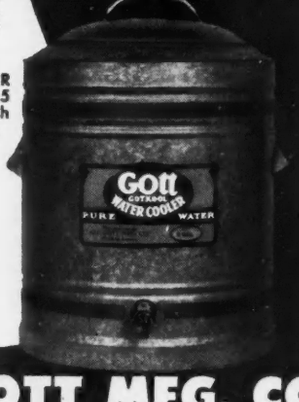

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Heat Losses from Buried Gas Gathering Lines

By J. T. SIMON
Chief Petroleum Engineer
Mountain Fuel Supply Company, Rock Springs, Wyo.

THE AUTHOR outlines methods for securing actual temperature data on a gathering system to check assumed values of heat loss to soil. Such data are valuable in designing equipment for preheating gas to insure against formation of hydrates between wellhead and centralized dehydration plant. Intermediate heaters, placed in accordance with experimentally obtained data, eliminates need for auxiliary equipment.

THE effect of pressure and temperature on the formation of hydrates in natural gas pipe lines is well known. As indicated from published curves, the higher the pipe line pressure the higher will be the temperature at which gas hydrates will begin to form.

For a given operating pressure in the pipe line, if the temperature of the flowing gas can be maintained above the expected hydrate formation temperature, no hydrates will accumulate. This can be done by the installation of heaters at successive intervals along the pipe line to maintain the temperature of the flowing gas. Where large volumes of gas are to be transported long distances, this is not practical because of the fuel requirements for the heaters and the rapid loss of heat from the flowing gas to the surrounding ground. Gas dehydration becomes a must under these conditions; however, in some fields the gathering systems may be so extensive that hydrates may form before the gas reaches the dehydration plant. Under these conditions, well heaters or intermediate heaters to keep the flowing gas temperature above the hydrate temperature are justified.

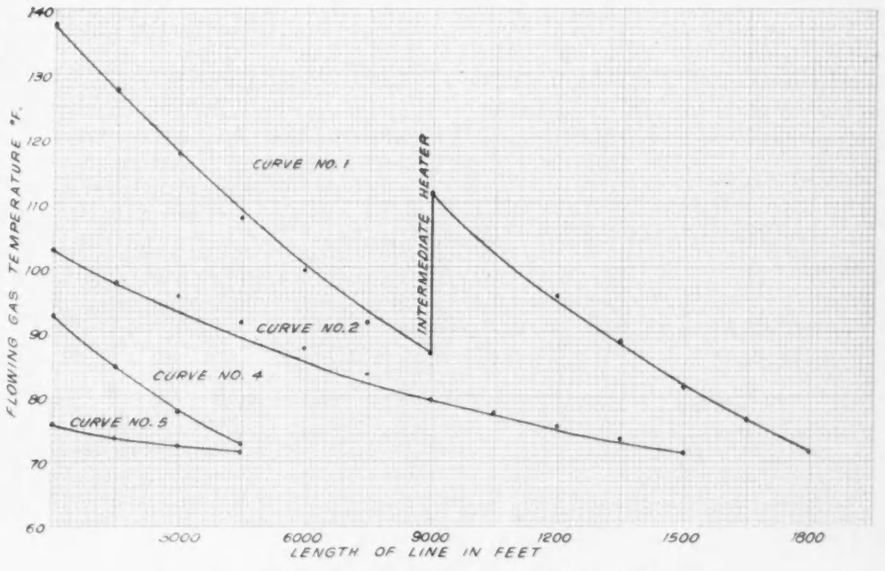
Gas production from the Church Buttes field required that a low-water, low-hydrocarbon dewpoint gas be made available for the gas transmission line. Since well pressures were high and plant investment was to be kept at a minimum, it was decided to dehydrate the gas at approximately 1500 pounds per square inch, using a solid desiccant-type plant. After dehydration, the gas pressure is reduced to 400 psi and the natural cooling derived from the pressure drop causes condensation of the hydrocarbons which are removed from the gas stream by a horizontal oil and gas separator.

The necessity for dehydration at a high pressure raised the hydrate forming temperature of the gas upstream from the plant to slightly under 70° F. This developed the problem of determining in advance whether or not the gas could be flowed to a central dehydration plant with only the heat added by the heater located at the well. The most critical section seemed to be the four-inch line from Unit Well 2 to the dehydration plant, approximately 3.5 miles.

In determining this, the heat available in the gas must equal the heat lost to the ground for a given length and size of pipe. The heat available in the gas is:

$$VC_p (T_1 - T_2)$$

The heat lost to the ground is:



Temperature drop in gas gathering system, Church Buttes field.

$$HAL(MTD)$$

$$MTD = \text{Mean Temperature difference} = \frac{(T_1 - T_g) + (T_2 - T_g)}{2}$$

Where:

V = Gas Volume, Mcf/Hr.
C_p = Specific heat of gas, Btu/Mcf/°F
T_1 = Gas temperature entering line, °F
T_2 = Gas temperature leaving line, °F
T_g = Ground temperature at depth of line, °F
H = Heat loss coefficient, Btu/°F/MTD/Sq. Ft./Hr.
A = Outside area of pipe, Sq. Ft./Ft. of length
L = Length of pipe line, Ft.

Therefore:

$$VC_p(T_1 - T_2) = HAL(MTD)$$

$$VC_p(T_1 - T_2) = HAL \frac{(T_1 - T_g) + (T_2 - T_g)}{2}$$

$$VC_p(T_1 - T_2) = HAL \frac{(T_1 + T_2 - 2T_g)}{2}$$

Solving for T_1:

$$2VC_p(T_1 - T_2) = HAL(T_1 + T_2 - 2T_g)$$

$$2VC_pT_1 - HALT_1 = 2VC_pT_2 + HAL(T_2 - 2T_g)$$

$$T_1 = \frac{2VC_pT_2 + HAL(T_2 - 2T_g)}{2VC_p - HAL}$$

For a given condition all of the above values are known, with the exception of the heat transfer coefficient. Inasmuch as there was no actual experience indicating the heat transfer coefficient for Church Buttes soil, an assumed value was necessary. Actual values for soil in the Carthage field of East Texas varied from 1.5 to 2.0 which was considered to be wet soil. Published data indicate that heat loss coefficients for wet soil should run 1.5 and for dry soil 0.3. Since Church Buttes soil is dry and using an average value of 1.75 for wet soil as at Carthage, then the assumed value for Church Buttes should be 0.35. The conditions for the line from Unit Well 2 to the dehydration plant would be:

V = 208 Mcf/Hr.
C_p = 35 Btu/Mcf/°F
T_2 = 70° F
H = .35
A = 1.18 Sq. ft./ft. for 4-inch line
L = 18,000 ft.
T_g = 32° F at 3 ft. deep

Using these values and solving for T in the above equation:

$$T_1 = \frac{(2 \times 208 \times 35 \times 70) + (.35 \times 1.18 \times 18{,}000\,[70 - 64])}{(2 \times 208 \times 35) - (.35 \times 1.18 \times 18{,}000)}$$

T_1 = 149° F.

The heater at the well was sized to give this temperature at the inlet to the gathering line. From this it looked as though it would be possible to flow this gas to the plant at the required temperature without an intermediate heater. Actual experience showed this was not the case for two reasons. The well was not capable of a sustained production at the estimated rate and the assumed heat transfer coefficient was too low. The installation of an intermediate heater on the pipe line midway between Unit 2 and the dehydration plant and the burying of this line six feet deep has made it possible to operate it satisfactorily under winter weather conditions.

In order to gain information on actual temperature drop in the Church Buttes gathering system, temperature wells were installed every 1500 feet on the entire gathering system. These consisted of a one-inch pipe welded to the gathering line and extending approximately one foot above the surface of the ground. The bottom three inches of this pipe was filled with mercury which was in direct contact with the pipe line. A six-inch maximum registering stem thermometer was lowered into the mercury and left for one minute. It was then removed and the skin temperature of the buried line was read directly from the thermometer. A check of the temperature obtained in this manner, with a dial thermometer inserted in the gas stream, indicated that there was only about 1.5 degrees difference in the two methods. A series of tests made in the field during the past two winters indicated a minimum ground temperature of 32° F at the 3-foot depth and 40° F at the 6-foot depth.

Presented lure is a series of curves showing the temperature drop actually measured along various portions of the Church Buttes gas gathering system.

Curve 1 indicates the temperature drop along the 4½-inch OD lateral from Unit Well 2 to the dehydration plant shown on the accompanying map. This line was buried three feet and was running 7000 Mcf of gas when the readings were obtained. This volume could not be maintained and even with the intermediate heater, the line froze off with 2500 Mcf per day flowing from Unit Well 2. During the past summer, the depth of this line was increased to six feet. We have been able to keep this line operating by gradually increasing the heat as the ground temperature dropped. The temperature readings taken along the line have been very erratic, probably due to the recent lowering of the line with insufficient time for settling of the backfill.

Curve 2 shows the temperature drop along the 4½-inch outside diameter line from Unit Well 4 to a junction with the 6⅝-inch OD line near Unit Well 1. This line is buried six feet deep and had been handling 10,534 Mcf of gas per day when the readings were taken. An intermediate heater was installed on the line about 9000 feet from Unit Well 4. This was required as the line was initially put in service in the winter. As soon as the temperature on this line is brought above the hydrate point, the intermediate heater is turned off.

Curve 3 indicates the temperature drop along the short 4½-inch OD line from Unit Well 3 to a junction with the 6⅝-inch OD line near Unit Well 1. This line is buried 6 feet deep and was passing 4270 Mcf of gas when the temperatures were obtained.

Curve 4 shows the temperature drop on the 6⅝-inch OD line from near Unit Well 1 to the dehydration plant. This line is buried six feet deep and was passing 25,344 Mcf when the temperatures were taken.

A glance at the curves will show how varying conditions of line size, depth and volume of gas flowing will affect the slope of the temperature gradient curve.

Using the actual values obtained form these curves, together with other known data and solving the previously mentioned equation for the heat loss coefficient, the values in table 1, were obtained:

The establishment of the actual heat loss coefficient for Church Buttes soil makes it very easy to predict in advance whether a given set of conditions in any proposed gathering line will remain free of hydrates upstream from the point of dehydration.

TABLE 1

GATHERING LINE	Line Size	Depth	Heat Loss Coefficient (H)
Unit No. 2 to Int. Heater	4½" OD	3"	0.593
Unit No. 4 to 6⅝" Junction	4½" OD	6"	0.567
Unit No. 3 to 6⅝" Junction	4½" OD	6"	0.546
Unit No. 1 to Plant	6⅝" OD	6"	0.559
Average H value for Church Buttes soil			0.566

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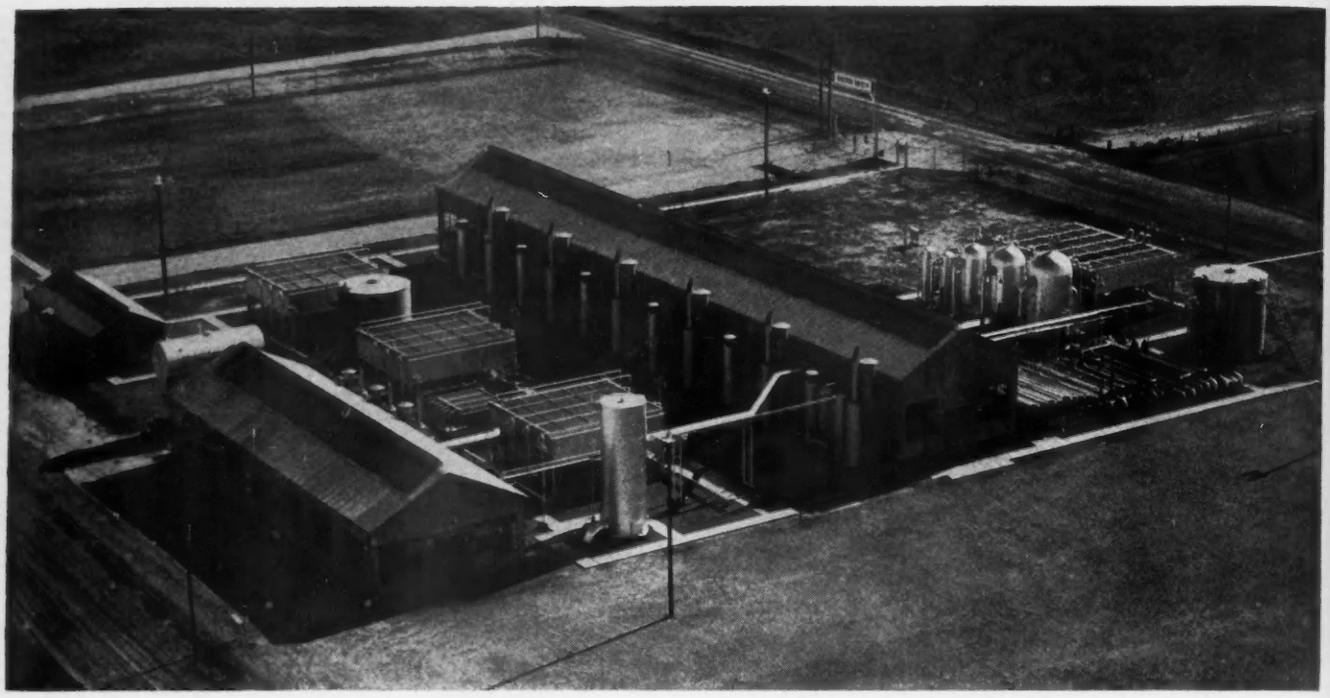


Aerial view of the new Willamar pressure maintenance plant dedicated September 6, 1951. The plant is in Willacy County, Texas.

Advanced Design Incorporated in New

By R. F. PARKER,

DEDICATION CEREMONIES September 6 officially inaugurated the Willamar pressure maintenance project of Willacy County, Texas, but the modern and efficient compressor plant had already completed its test run and was "on the line." The author discusses the general layout of this new compressor plant, and points out those features which make it unusual in its field and advanced in design. Simplified flow diagrams indicate the flexibility achieved in the design of the Willamar plant. Not only was this modern plant completed ahead of schedule, but it was constructed at a cost which was considerably less than original estimates.

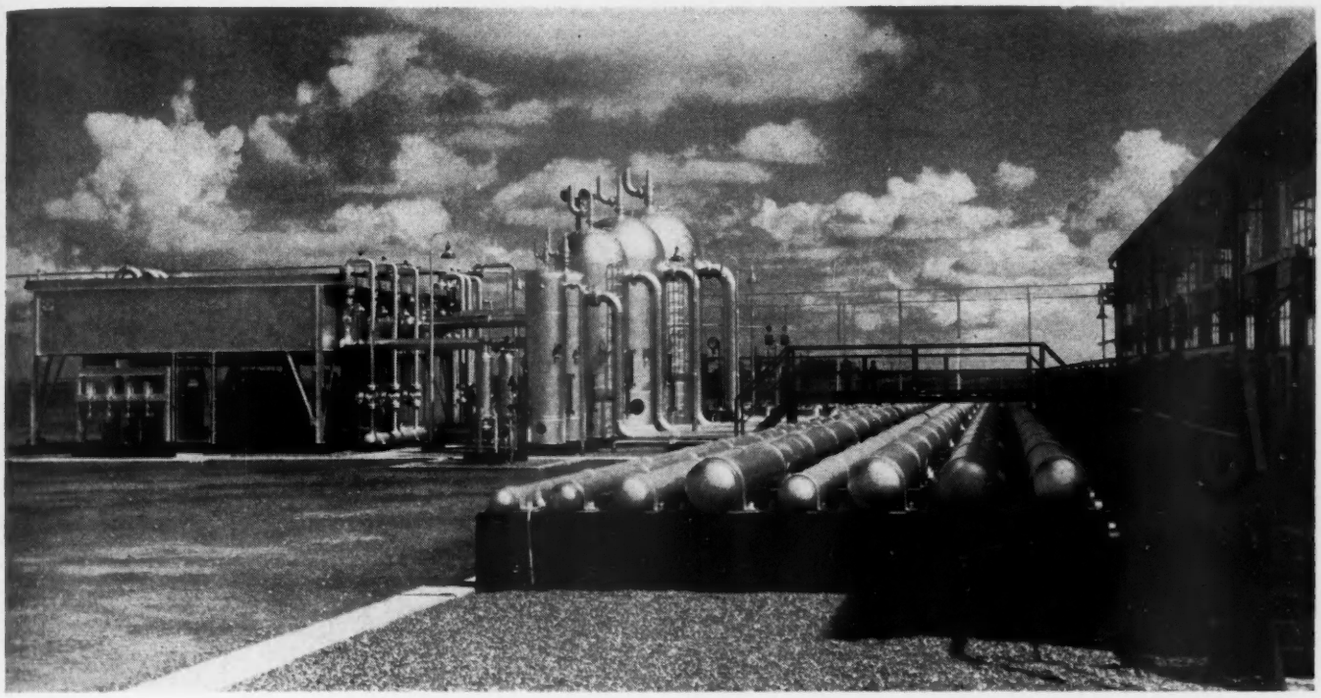
WHEN the Willamar West Field Pressure Maintenance Plant was dedicated September 6, another step was achieved in gas conservation in Southwest Texas. A significant feature of this entire program is the ultra-modern compressor plant which is unusual in design and flexible and safe in operation. Through the cooperation of all concerned, this plant in Willacy County, Texas, was designed and constructed within a close time schedule and at a cost considerably below the original estimates. The design and equipment are modern in all respects, and many features of the plant are unusual and worthy of study by designers and constructors of similar plants.

The Willamar plant is perhaps the only large, multi-stage compressor plant which is entirely air cooled. It is one of the largest repressuring units of its kind not associated with a liquid extraction plant. Because of the uncertainty of the exact quantity and pressure of gas to be handled, extreme flexibility has been achieved. It can operate efficiently at widely varying inlet and injection pressures and at wide variations in relative quantities of gas to be handled. The emergency and manual shutdown system includes many design features not normally found in such plants.

Basis of Design

Pressure maintenance operations commenced August 1, 1951, (see page 202, October, 1951, WORLD OIL) when the unitization agreement of the Willamar West field became effective. Flares throughout the field were snuffed out as the gas was returned to the formation to conserve reservoir energy.

Gas from field separator batteries enters the plant through two gathering systems. One system operates at low pressure, delivering gas to the plant inlet scrubbers at 50 pounds per square inch absolute. The other system supplies the plant scrubbers



On west side of plant are, left to right, interstage gas coolers, instrument gas dehydrators, battery of gas scrubbers, and gas headers.

Willamar Pressure Maintenance Plant

Consulting Engineer, Houston

at 300 pounds absolute. Field gas is metered as it enters the plant through four orifice meter runs.

Compression of gas is in four stages. Fifty-pound gas is compressed to 300 pounds in two stages. At this point, the 300-pound field gas enters the compression system. The third stage rises the pressure to 900 pounds absolute, at which a small portion is withdrawn for gas lift operations in the field. The fourth stage of compression raises the pressure to 3000 pounds absolute. This high-pressure gas leaves the plant in two headers which deliver to the various injection wells in the field. Jacket water for all engines, gas and lubricating oil are air cooled in finned cooling sections.

The compressor and generator engines are equipped with the usual safety shutdown devices, in addition to which is a special feature actuated by the high liquid level in the scrubbers and high or low pressure on the gas lift or injection system. Manual stations are conveniently located from which the entire plant can be shut down and/or vented to the atmosphere.

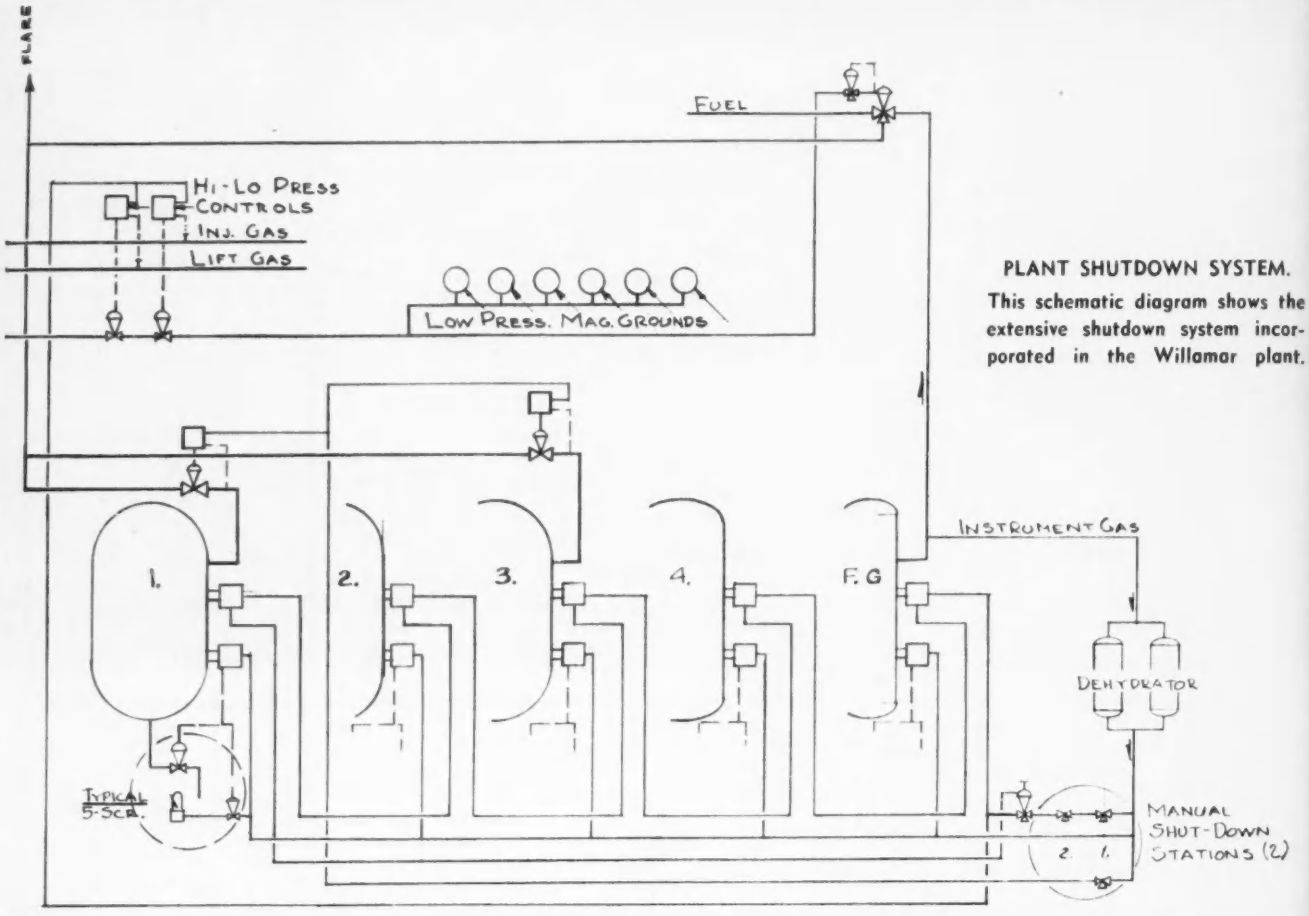
The plant was designed for an ultimate capacity of 58 million cubic feet per day with an initial capacity of 33 million cubic feet daily. All facilities are either installed for the full capacity, or they are so designed and installed that expansion to the ultimate capacity can be accomplished without waste.

All mechanical auxiliaries are electric motor driven. Power is supplied for these units by any two of three 250-KVA, 3-phase, 60-cycle generators. Each generating unit is direct connected to 303 brake horsepower engines operating at 400 revolutions per minute. Two of these generators will handle the ultimate load of the completed plant.

A large measure of flexibility of operation has been built into the Willamar plant. The exact trend of the field in regard to quantity and pressure of gas to be produced with

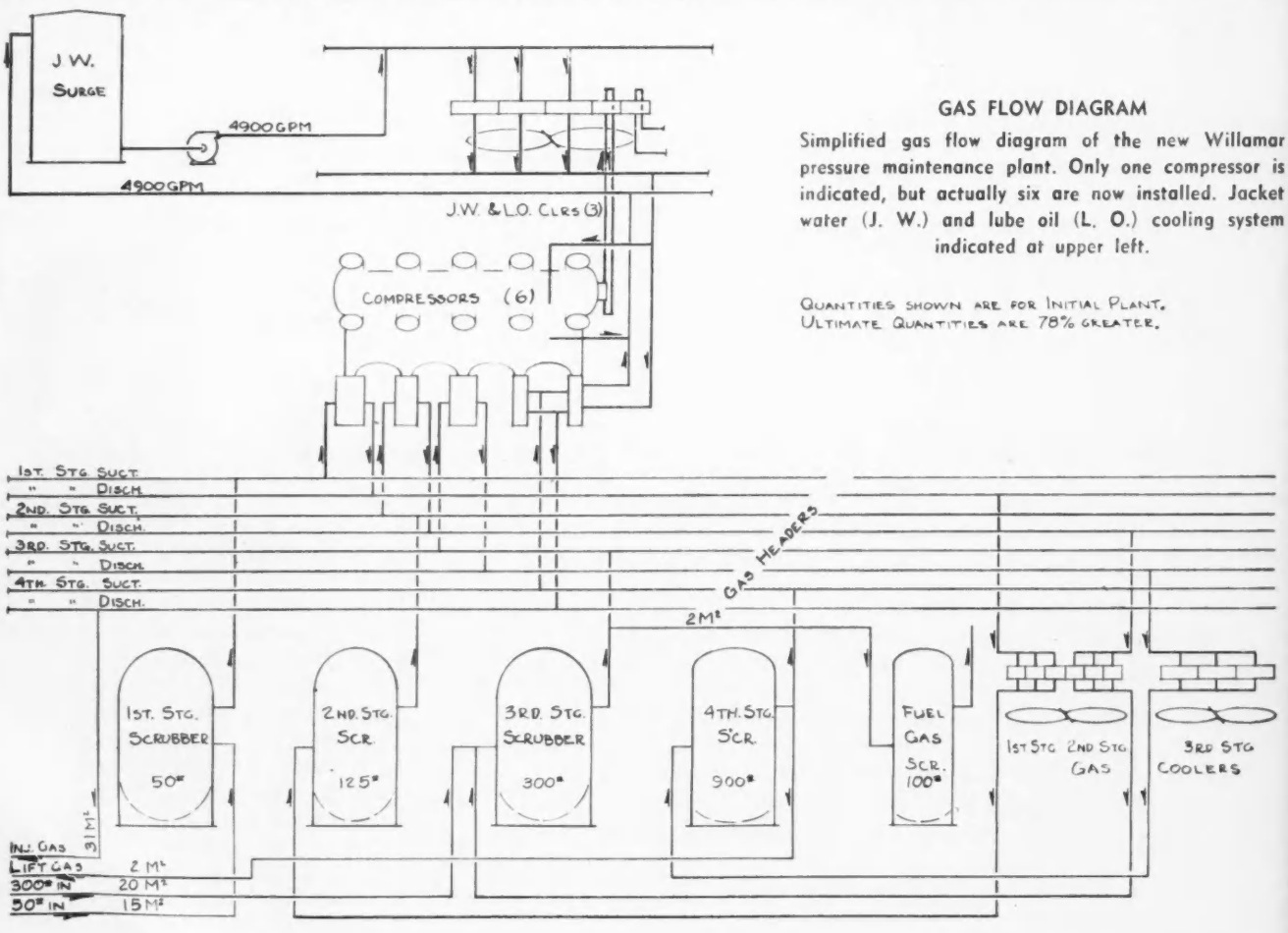
About the Author

R. F. PARKER is a native of Texas and a graduate of Rice Institute, Houston. In addition to six years of teaching mechanical engineering and four years in the Army Engineers, Parker has been engaged in the design and operation of chemical and petroleum processing plants in the Southwest for more than seven years. He was employed as consulting engineer on the design of the Texas Illinois Natural Gas Pipe Line which is to go into operation late this year.



PLANT SHUTDOWN SYSTEM.

This schematic diagram shows the extensive shutdown system incorporated in the Willamar plant.



GAS FLOW DIAGRAM

Simplified gas flow diagram of the new Willamar pressure maintenance plant. Only one compressor is indicated, but actually six are now installed. Jacket water (J. W.) and lube oil (L. O.) cooling system indicated at upper left.

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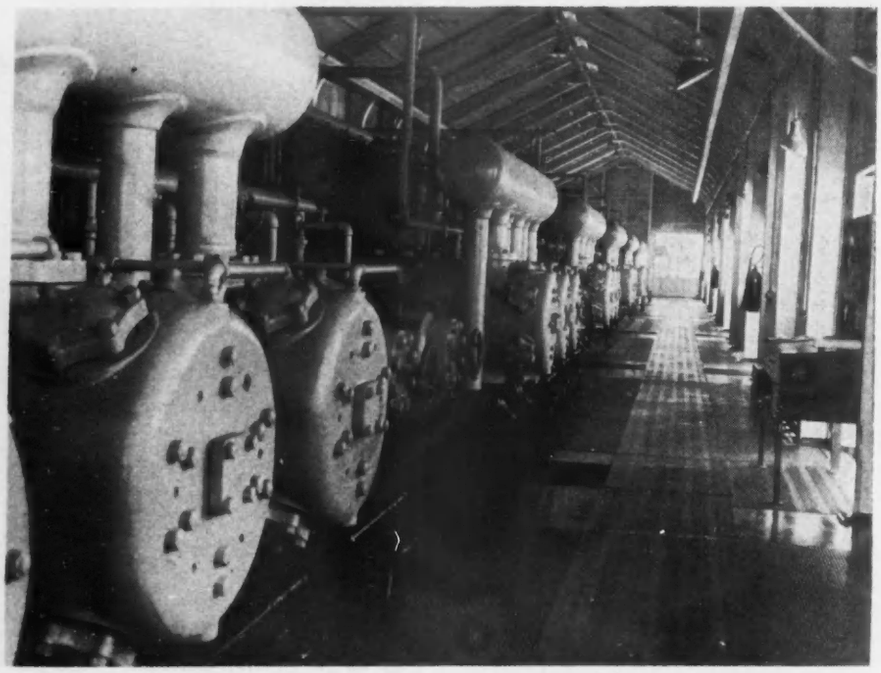


Interior of the compressor building. Note the three-compartmental suction bottles above the compressor cylinders of each unit. The building now houses six units; for ultimate capacity, three units will be added.

the oil is not definitely known, and therefore, the necessity for this degree of flexibility. The plant can operate efficiently at widely ranging inlet and injection pressures, as well as at wide variations in relative quantities of gas to be handled.

Because of the serious water treating problem and the availability of water, it was necessary to design a complete air cooling system for this plant. It is perhaps the only plant of its type that is distinguished by this exclusive feature. The plant also includes one of the most extensive shutdown systems yet installed every possible eventuality was taken into consideration when this system was designed and installed.

Plant Compressors

The initial compressor installation consisted of six gas-driven compressors totaling 6850 horsepower. Five of these units are rated at 1100-horsepower each, and the sixth is supercharged for a rating of 1350 horsepower. The 1100-horsepower units can be converted to 1350 horsepower in place by the addition of the necessary parts. No major alteration is required.

Compressor cylinders are so sized and provided with clearance as to utilize the full 1350 horsepower when the engines are supercharged. The first, second and third stage volume bottles for the compressors were combined into three-compartment vessels for each compressor. This feature is shown in the photograph taken inside the compressor building. This construction presents a neat appearance as compared to separate vessels, and requires fewer fittings and less space. Pulsation dampeners were installed in the third and fourth stage discharge lines on each compressor to reduce the surge characteristics of the gas under the higher pressures.

Excess jacket water temperature or low lube oil pressure actuate alarm and safety devices. First indication of high temperature or low pressure is the simultaneous sounding of a horn and the flashing of a red light on the instrument panel. This light designates which engine is in trouble. If the trouble is corrected and temperature and/or pressure are brought back to normal, the alarm ceases. If the jacket water temperature continues to rise or if the lube oil pressure steadily falls, the engine magnetos are grounded, the fuel supply for that particular engine is cut off, and the engine fuel line is opened to the blow down flare line.

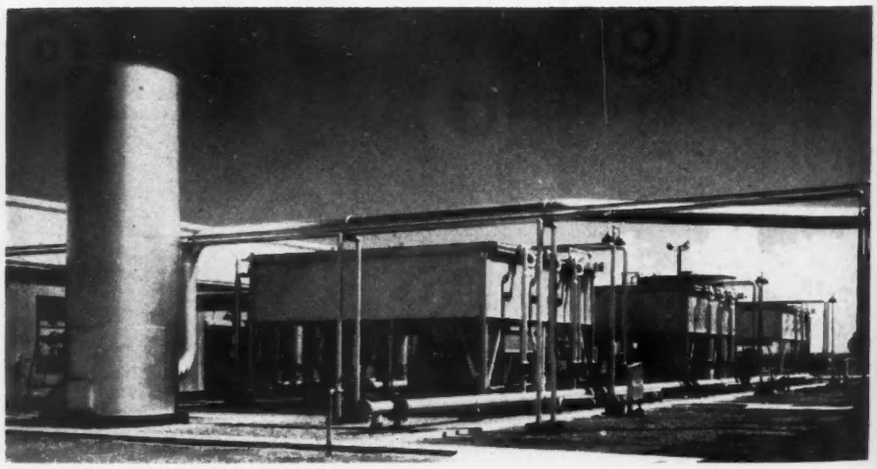
Exhaust Silencers and Air Cleaners

Silencers have been provided on the engine exhaust to absorb the noise from the plant. Exhaust lines from each main engine and from the generator engines to the mufflers are jacketed with a sheet metal cover. The annular opening between the exhaust pipe and the jacket is open into the building and is vented outside in a sheet metal stack with a vent cap separate from the exhaust stack.

Intake air cleaners use air filter elements which may be removed for cleaning and replaced by cleaned elements in a matter of minutes. These elements are in one chamber of a pulsation dampener on the intake air line. This design contributes materially to quiet operations.

General Shutdown System

An extensive emergency shutdown system was employed to completely shut down the plant when actuated by any of a number of causes. The heart of the system is a group of six pressure actuated switches which ground the magnetos of the compressor engines upon failure of pressure in the shutdown system. Loss of pressure in this system also cuts off the fuel supply to the compressors and vents the



On the east side of the compressor building are jacket water and lube oil coolers, with jacket water surge tank at left.

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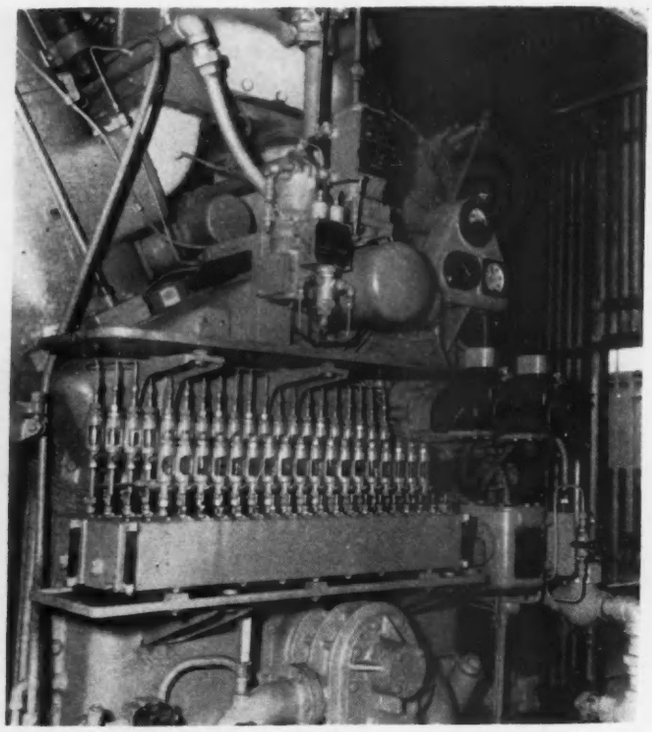
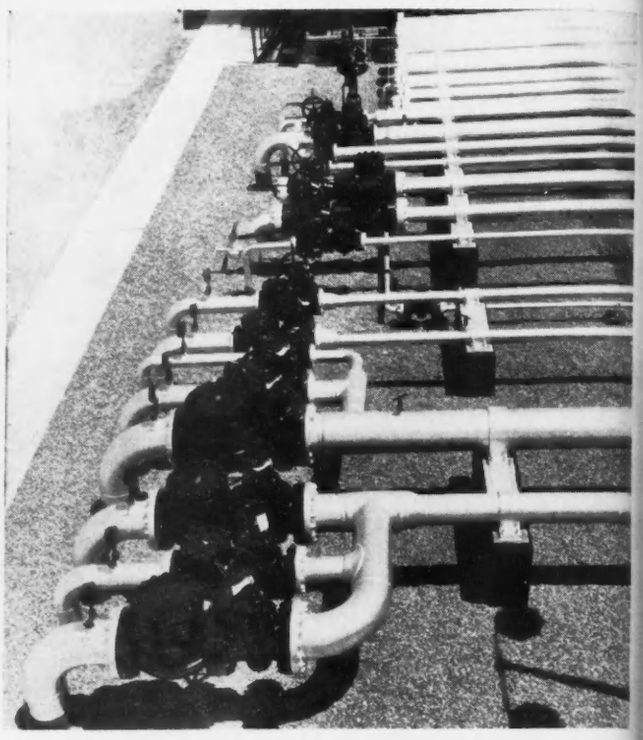


This is the auxiliary end of the compressor engines, showing oil pump, lubricating system, governor, and emergency shutdown devices.



Lines in foreground bring gas into plant at two pressures; beyond are injection and gas lift discharge lines. Station headers are in background.

fuel system into the plant flare line. Recovery of pressure in the shutdown system does not reset this device, for it must be reset manually.

Each suction scrubber and the fuel gas scrubber are equipped with two liquid level controls. The lower control operates the drain valve on the scrubber to maintain a desired liquid level in the scrubber. A high level alarm arrangement causes a whistle to blow when the level in the scrubber reaches the high limit of this lower level control. The upper level control bleeds gas from the emergency shutdown system, causing the main compressors to be shut down and the fuel system vented through the plant flare line.

Two pressure control devices are also connected into the emergency system to shut down the main engines as previously described. One of these pressure controls is actuated by excessively high or very low pressure on the gas lift system. The other is actuated similarly by high or low pressure on the injection gas header.

In addition to the automatic devices described, two manual shutdown stations are provided. These manual stations consist simply of three-way valves. When thrown to shutdown position, the supply of instrument gas to the emergency shutdown system is cut off and the system bled down. The shutting down of the main engines is accomplished as previously described.

The hookup of the upper level controls is unusual. (See diagram.) The five level controls are connected in series and supplied with instrument gas. The output of the fifth is applied to the diaphragm of a three-way valve in the emergency shutdown line ahead of the first level control. High level at any of the scrubbers bleeds pressure from this line and the three-way valve is closed by spring action. Its closing shuts off gas from the emergency shutdown system and bleeds the gas out of the system. It may be seen that the three-way valve cannot open, even though the liquid level falls to a safe level. This three-way valve is opened manually and must be held open until the system is re-pressured. Thus, whenever a high level in one of the scrubbers shuts down the plant, it must be started up again manually.

Back-pressure control valves are on the 50-pound and 300-pound inlet gas systems. These controls vent gas to the flare line whenever pressure builds up beyond a predetermined value in either of these systems. Both of these valves open on failure of instrument gas supply. Instrument gas is supplied through a three-way valve at one of the manual shutdown stations. Throwing this valve shuts off the supply of gas to the back-pressure controls and bleeds off the gas already in the line. This opens both back-pressure valves and vents the 50-pound and 300-pound suction scrubbers to the flare line. Inasmuch as field gas enters the plant through these two scrubbers, this feature effectively vents the plant and cuts off the supply of gas.

None of the shutdown devices mentioned serve to shut down the generator engines. At each of the manual shutdown stations located away from the building structure, there is a switch for grounding the magnetos of the generator engines. Thus, the plant can be completely shut down from the manual stations. The pneumatic controls for these various shutdown safety controls are supplied clean gas which has been dehydrated by two dry desiccant-type dehydrators which are shown in the illustration of the battery of gas scrubbers.

Cooling Systems

The cooling system for the Willamar plant is among the first of its kind and is an engineering accomplishment for this type of plant. Not only is it advantageous in eliminating the water treating and supply problem, but is is expected that maintenance on this system will be at a minimum.

Cooling of jacket water for the main engines and generator engines and lube oil for the main engines is accomplished in three air-cooled units. Each unit consists of three single-pass jacket water cooling sections and two single-pass lube oil sections. (See

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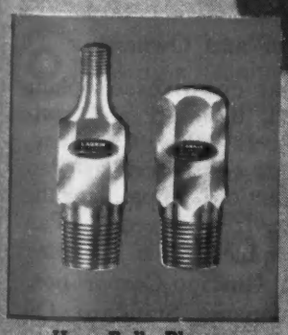

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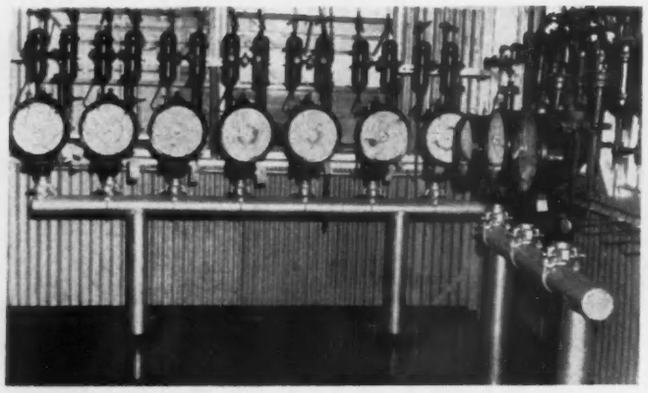
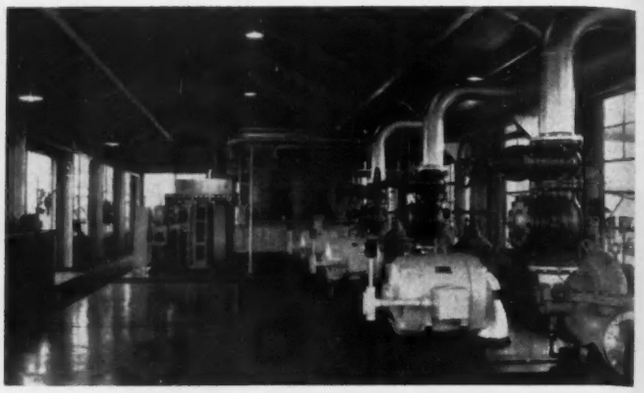


All gas measurements, both incoming and discharge, are recorded by this battery of recorders inside the compressor building.



Interior of auxiliary building which houses generators and engines (background) and electrically-driven jacket water pumps (right).

simplified flow diagram.) Jacket water for the main and generator engines is handled in a common system. Lube oil for the six main engines is handled in six separate systems. Lube oil for the generator engines is cooled in a single unit containing three two-pass cooling sections.

Jacket water is circulated by three pumps rated at 2750 gallons per minute capacity. Interstage gas cooling is accomplished in two air-cooled units. One unit contains three single-pass sections on the first stage discharge cooling and three two-pass sections on the second discharge cooling. The other unit consists of three two-pass sections on third stage discharge cooling.

Gas coolers are finned tube bundles through which air is blown upward by large propeller-type, electrically-driven fans. Coolers are sized for the ultimate capacity of the plant and are designed for a 20 degree Fahrenheit approach to ambient air temperature. The fourth stage discharge gas is not cooled, but leaves the plant at compressor discharge temperature.

By referring to the simplified flow diagram, the cooling system can be traced. Jacket water from the air coolers enters each compressor in two parallel streams, namely, the engine jacket water stream and the compressor cylinder cooling water stream. After discharging from the engine and compressor cylinders, the water flows into a common header. The jacket water header leads to the vertical jacket water surge tank. This surge tank supplies water to the jacket water circulating pumps located in the auxiliary building next to the compressor building. The pumps discharge into a header which distributes the hot jacket water to the coolers.

The jacket water coolers discharge into a header from which each engine is supplied with cooling water. Each compressor oil pump discharges to a cooling section in one of the jacket water cooling units, and the oil is circulated in a closed system to which make-up oil may be added.

Gas Flow Sheet

The simplified flow diagram of the gas through the plant gives a better understanding of the manner in which the gas is handled at the various pressures. The low pressure gas (50 psia) enters the plant through the first stage suction scrubber. Entrained fluids or foreign particles carried over from the field separators are removed here. From this scrubber, the gas enters the first stage suction header.

Gas then enters the first stage suction bottle on each compressor and then into the compressor cylinder. After the first stage of compression, the gas leaves the compressor through a second compartment of the discharge bottle, and then to the first stage discharge header.

Gas flows from the discharge header to the first stage discharge cooler where it is reduced to a temperature approximately 20 degrees above ambient air. Any liquids, water or hydrocarbons condensed in the first stage cooler are removed in the second stage scrubber. The path of the gas through the remaining stages is identical with the first stages with one exception. Field gas at 300 psia joins the second stage discharge gas just before it enters the third stage suction scrubber.

Fuel gas and instrument gas are taken out of the system immediately after the third stage suction scrubber. Gas-lift gas is taken out of the system immediately after the fourth stage suction scrubber. Discharge from the fourth stage is not cooled, and the gas leaves the plant at compressor discharge temperature (about 300° F.) and at about 3000 psia.

Expansion to Ultimate Capacity

The necessary additional compressor horsepower requires two changes. The addition of three more 1350-horsepower compressors will provide a total of 4050 horsepower to the present plant. An additional 1250 horsepower can be obtained by supercharging each of the five 1100-horsepower units up to 1350 horsepower.

The main compressor building and all headers will require lengthening an additional 84 feet. Suction scrubbers and all headers are sized for the ultimate capacity. The added horsepower will require the addition of one air cooler for jacket water and lube oil cooling. This unit will have three oil cooling sections and slightly less water cooling surface than the original units. Jacket water pumps are sized for ultimate capacity and so are the interstage gas coolers, and these will not be changed.

Operator and Owners

The Willamar compressor plant was engineered, designed and constructed by O. L. Olsen Company, Houston, and is operated by Pan American Production Company for the Willamar Unit. It is owned by Pan American, Humble Oil & Refining Company, The Chicago Corporation, Shell Oil Company, Standard Oil Company of Texas, Sun Oil Company, G. T. Bauerdorf, David C. Bintliff, C. H. Lyons, C. R. Nichols, K. D. Owen, W. P. Prentiss, J. B. Stoddard, et al, and the City National Bank of Houston, Trustees. All of the participants in the plant ownership except Humble are also participants in the unitization agreement.

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Surface Activity as Applied to Secondary Petroleum Production

By DR. FOSTER DEE SNELL and DR. CORNELIA T. SNELL

Foster D. Snell, Inc., New York City

FUNDAMENTAL CONSIDERATIONS for increasing the flushing action of flood water are discussed in detail. Surface active agents to induce preferential wetting of sand by flood water rather than by oil are being studied widely. The authors discuss the results of many compounds used to accomplish preferential wetting, and briefly describe the methods used in measuring the characteristics of these surface active agents. Preferential wetting can be accomplished, but so far, experiments show that a reduction in interfacial tension has resulted. Specifications for an ideally suited agent for use in treating flood water are outlined, and several suggestions for study are presented.

THE petroleum industry has already benefited enormously from surface-active agents. One example is in the breaking of emulsions, another the performance of drilling muds where surface phenomena play an important part. A glance at the emulsion problem is justified as roughly the reverse of the present topic. Such an emulsion consists of an inner phase, water, dispersed in an outer phase; and oil, with a surface active agent plating the water droplets and stabilizing the dispersion. Destruction of the surface active agent, as by discharge by an agent of the opposite sign, causes the emulsion to break. The outer phase is already continuous. The inner phase coalesces and separates as another layer.

In the problem of water-flooding of oil sand for secondary recovery, the inner phase is the oil present in the interstices of the sand structure. The problem is then to place a surface-active agent barrier at the interface between sand and oil. The agent must be so sorbed as to render the sand surface more polar. As a polar surface it will repel the oil. This action is limited only by the crude having some polar properties, which are not too great, particularly for a paraffinic oil. Then a third phase, a second liquid phase, water, can readily push out the oil if the sand is now more readily wet by water than by oil. Practically, these reactions have to occur sequentially in a small depth of face at the front of the water drive.

Secondary petroleum recovery by water flooding has proved its value in several locations. For example, at Bradford, Penn., recoveries of 5000-7000 barrels of oil per acre were obtained,[8] and 579 barrels per acre in North Texas.[7] Water recovery is expensive, and not satisfactory with all sands. But even where it has been applied successfully, as in the Bradford fields where the usual pumping methods resulted in a recovery of about 10 percent of the original oil, subsequent water-flooding increased the total recovery to only about 25 percent.[2] How to increase the efficiency of water-flooding is a problem facing petroleum chemists and engineers. Can some chemical, possibly but not necessarily a synthetic surface-active agent, be added to give increased production?

The reply of one versed in surface chemistry would be "Yes, in all probability," to such a question. Finding an agent with the desired physical and chemical properties is not the whole problem. Many practical factors that go much further require consideration. As a first step, however, the chemistry, particularly the physical chemistry, of the problem should be reviewed.

Nature of Surface-Active Agents

A surface-active agent is a material whose primary effectiveness is a result of surface chemistry. In speaking of surface chemistry, it is understood that by "surface" is meant any phase boundary.[16] It is usual to speak of chemical and physical forces. Physical forces are not directed in the same sense that chemical forces are; thus the force which holds water molecules together in a liquid is the diffuse Van Der Waals' Attraction. Many of the most typical surface phenomena such as flocculation, wetting and sorption may be explained largely in terms of physical forces. Sorption is often governed by the generalized and rather weak Van Der Waals' attractive forces or by forces or by equally generalized electrostatic forces of attraction. On the other hand there can occur activated sorption, which is highly specific and which is accompanied by free-energy changes of scores of kilocalories per molecule.

Essentially, a surface-active agent is a substance which tends to concentrate at certain types of interfaces. A molecule of surface-active agent is always highly unsymmetrical, one section being polar and the other non-polar. The non-polar section is commonly a hydrocarbon chain. It is attracted to oily, fatty, or waxy substances and to air, in preference to water. The polar section is attracted to water rather than to oily phases or air. The water-attracting groups most commonly used are, in approximately decreasing order of effectiveness: sodium sulfate —OSO_2ONa, sodium carboxylate –COONa, sodium sulfonate –SO_2 ONa, acid sulfate –OSO_2-OH, and acid sulfonate –SO_2OH.[15] Groups having this effect to a lesser degree include –OH, –SH, –O–, =CO, –CHO, –NO_2, –NH_2, –NHR, –NR_2, –CH, –CNS, –COOH, –COOR, –OPO_3H_2, –OPO_2H_2, –OS_2O_2H, –CI, –Br, –I, and unsaturated bonds.

Surface-active agents fall into one of three classes: anion-active, cation-active, and nonionic. Soap with a structure of RCOONa, where "R" represents a hydrocarbon chain of the range C_{11} to C_{17}, is anion-active; it ionizes with sodium as a positive ion and all of the rest as a negative ion

or anion. Although more than 800 different surface-active agents are known under brand names, the actual structures which possess general surface-active properties are quite limited in number.[17] The more important ones can be classified in to about ten classes, listed as follows, with examples of a few well known commercial products:[14]

I. Anion-active agents

1. Sodium alkyl-aryl sulfonates—Nacconol, Santomerse, Oronite.
2. Sodium alkyl sulfonates—MP 189.
3. Sodium alkyl sulfates—Duponol, Gardanol, Dreft.
4. Sodium salt of sulfated and sulfonated amides—Igepon T.
5. Sodium salt of sulfated monoglycerides—Vel.
6. Sodium dialkyl monosulfosuccinates—Aerosol OT.

II. Cation-active compounds

1. Benzyl trialkonium chlorides—Roccal, Zephiran.
2. Alkyl pyridinium chlorides—Ceepryn.
3. Substituted oxazolines—Alkaterge.

III. Nonionic compounds

1. Partial esters of polyhydric alcohols—Spans, Tweens.
2. Alkylated aryl polyether alcohol—Triton X-100.

Anion-active agents ionize in the same manner as soap. Cation-active agents ionize to give a small negative ion such as chloride, with all the rest as a positive ion or cation. Nonionic agents, as the name implies, do not ionize. Several of the nonionics contain polyoxyethylene as the polar portion of the molecule; for example, such a product as might result from addition of 10-12 molecules of ethylene oxide to a molecule of dodecyl alcohol. By varying the positioning and number of the ethylene oxide groups, a bewildering variety of agents can be, and has been, produced. Those mentioned are only illustrative.

Synthetic surface-active agents and particularly those expected to have the combinations of properties required of detergents are frequently evaluated in a preliminary manner by measurement of one or more physical properties.

Surface tension is conveniently measured in absolute units by means of the du Nuoy tensiometer. A synthetic detergent lowers surface tension from a value of about 72 dynes per centimeter to about 25-35 for a 0.1 percent solution of agent. This means that literally the solution will wet air better than plain water will, usually manifested by foaming properties.

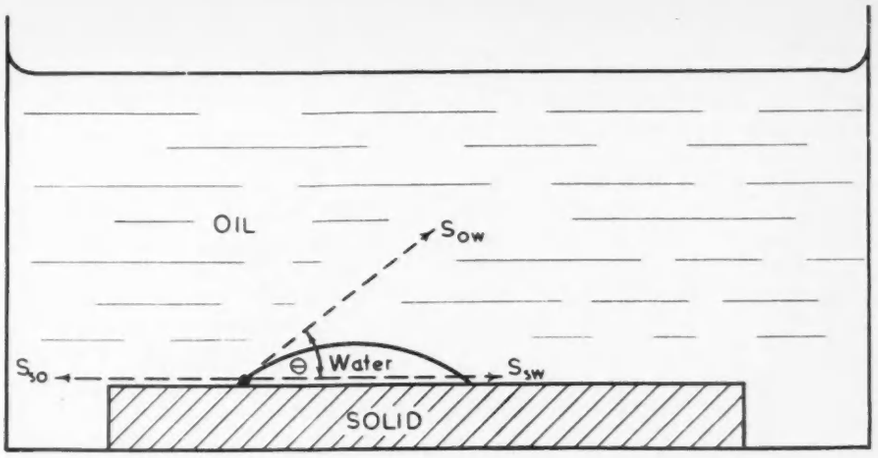

FIGURE 1

Interfacial tension is also measured by the du Nuoy tensiometer. A synthetic detergent lowers interfacial tension at a fatty-acid contaminated water-oil interface from 29 dynes per centimeter for plain water to five dynes per centimeter or less for an 0.1 percent solution of agent. This means that the solution will wet an oil surface better than plain water will wet the oil.

Emulsifying and dispersing power can be measured by a method recently published[18] which shows the ability of a sample solution to keep fine particles of oiled umber in suspension. By this technique, soap is shown to be a tremendously more powerful dispersing agent than the synthetic detergents tested. Soap shows a dispersing power of about 50 in comparison with that of synthetic detergents of only about ten. Plain water has practically no emulsifying or dispersing power and so will not hold oil droplets or solid particles in fine dispersion.

Wetting power may be measured by the contact angle of a solution of the surface-active agent on the surface to be wet. For textiles, it is more often measured by determination of the rate at which the solution penetrates a mass of fibers. The Draves, Herbig, and Canvas-duck tests are best known.

Preferential Wetting

Preferential wetting is a measure of the displacement of an oil or solvent by a solution of surface-active agent. It may be estimated by a recently published method which measures the time for an oil-soaked piece of cotton cloth to become wet by and sink through an oil-detergent solution interface into a sample solution. Oil-soaked fabric takes a very long time to be wet by plain water and even by solutions of some detergents, although certain polyvalent negative ions show strong preferential wetting under similar conditions; for example, molecularly dehydrated phosphates, carboxymethylcellulose and even potassium ferrocyanide. Such compounds are not surface-active in the usual sense but both molecularly dehydrated phosphates and carboxymethylcellulose have been proved exceptionally efficient as builders for synthetic detergents. It is believed that their action is due to sorption on the surface of a substrate, that changes the nature of the charge on the substrate.

Contact angles can be measured by several methods. One is placing a drop of liquid on a surface and taking measurements through a microscope equipped with a micrometer eyepiece. What is more important for this purpose is the three-phase contact angle. A drop of one liquid such as a surface-active agent is placed in water under an immiscible liquid such as oil, in contact with a plane solid surface. This measures the preferential wetting of the solid by one liquid or the other, in terms of the size of the contact angle, which can be read with the micrometer eyepiece. The smaller the contact angle or the closer its cosine approaches a value of $+1$, the greater the degree of wetting by water is being studied under an oil phase.

If a fatty acid such as oleic acid is dissolved in the oil phase, the wettability of glass by water is reduced; if

an alkali such as triethanolamine is dissolved in the aqueous phase, glass is wet much better than by plain water alone.[12] A quite different effect is obtained with steel under the same conditions. Oleic acid dissolved in the oil phase greatly reduces the wettability of steel by the aqueous phase. Triethanolamine in the aqueous phase increases the wettability somewhat by that phase. This work is cited to show the extreme importance of the nature of the substrate in any study of preferential wetting, a factor of importance with different types of oil sands. In the example given, glass may be assumed to be somewhat representative of a polar surface, of the same general nature as sand, steel of a nonpolar surface.

Nature and Wettability of Oil Sand

In different fields, oil reservoirs vary from a limit of substantially pure silica on the one hand to substantially pure calcium carbonate on the other. Other minerals present in dispersion in the sands are iron oxide, alumina, lime, and gypsum.[10] Such sand, free from oil, would be hydrophilic, or easily wet by water, but as oil sand it has been in contact with crude oil for a long period of time.

Crude contains a number of compounds of a somewhat polar nature, with sections based on oxygen, nitrogen, and sulfur. For example, naphthenic acid and homologues of isoquinoline are found in crude oil.[4] The former is mildly acidic in reaction, the latter mildly basic. Not only the sands but also the crude oils differ in composition according to the location and the field, a factor which further complicates the specific problem under consideration. Whatever compounds of polar-nonpolar structure may be present, they will have an effect varying only in degree in reducing the wettability of the sand by water.

Oil from Bradford, Penn., has been found to wet both a clean quartz surface and cleaned oil sand surface more readily than water. It is this trend which has to be reversed to accomplish the objective. A quantitative indication of the degree of polarity of one crude oil is that although pure paraffin hydrocarbons have an interfacial tension against water of about 50 dynes per centimeter, interfacial tension between a sample of this crude oil and water has been found to be as low as 13.5 dynes per centimeter. Measurement of advancing contact angles of water under several crude oils on quartz show that only one had a value less than 90 degrees.[5] This particular oil would wet pure quartz sand less readily than water would, in contrast to the behavior of the other half dozen oils studied.

There are further complications. Polar compounds or colloidal materials have been sorbed at the interface between crude oil and sand. Sorption of these compounds alters the surface of the reservoir material. It is this somewhat altered surface which must be wet in a water drive. In studying adhesion tension, it was found that each sample of crude oil has a different degree of adhesion on sand.

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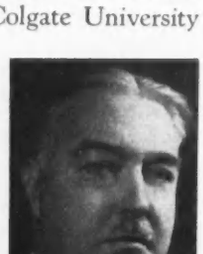
About the Authors



FOSTER DEE SNELL received his B. S. degree from Colgate University in 1919 and his M.A. and Ph.D. from Columbia University in 1922 and 1929, respectively. He instructed in chemistry at Columbia and at the College of the City of New York and was a consulting chemist until 1930, when he organized and became president of Foster D. Snell, Inc., New York. He is a member, Fellow and officer of many American and European professional and scientific societies and is listed in American Men of Science and other Who's Who rosters. His published books include four works on chemistry, including "Chemistry made Easy" in four volumes written in collaboration with his wife, Dr. Cornelia T. Snell, co-author of this article.

CORNELIA TYLER SNELL, author, lecturer and research chemist, received her B. S. degree from Syracuse University in 1919 and her M.A. and Ph.D. from Columbia University in 1925 and 1930, respectively. After finishing her studies Dr. Snell became a research assistant in various hospitals and later joined the staff of Foster D. Snell, Inc., consulting chemists and chemical engineers. She is also on the editorial staff of *Soap and Sanitary Chemicals*. She is a member of the American Chemical Society and has been active on various of its committees.

Theoretical Basis of Wetting

Displacement of oil from particles of sand and from the interstices between these particles is measured by a capillary-wetting function, the displacement pressure, which can be expressed by:

$$D_{wos} = S_{ow} \cos \theta$$

The pore spaces being of capillary size, the surface area of grains exposed in the interstices is of great magnitude.[21] The equation for preferential wetting of a plane solid surface does not apply here since a different function exists. In the above equation which does apply, D_{wos} is an expression for the energy of displacement pressure or force with which water displaces oil; S_{ow} is the interfacial tension between oil and water; and θ is the angle of contact of a drop of water under oil on a solid substrate. In the laboratory, this angle cannot be measured on sand but is measured on quartz glass with the assumption that the glass would have the same general physical properties in this measurement that sand would have. Figure I illustrates such a measurement diagrammatically.

This equation furnishes the fundamental basis for studying preferential wetting of oil sands. Interfacial tension and contact angles are both significant. The smaller the angle Θ, the closer the value for cosine Θ approaches $+1$ and hence the greater the tendency of water to displace oil. For water to wet sand, the displacement pressure, D_{wos}, must be as large as possible. For this to be true, not only must cosine Θ approach 1 in value, but also interfacial tension, S_{ow}, must be as large as possible. This means for the greatest efficiency in displacing oil from sand in a water drive, any agent introduced to promote preferential wetting by water should not reduce interfacial tension between water and oil, but should have the same value as that of pure water, or at least should be as close as possible to this value. Ideally, it should have a higher interfacial tension.

The fact that an agent which strongly reduces interfacial tension between oil and water is not applicable to the present problem, is indicated by the fact that addition of a surface-active agent to water can decrease the ability of water to penetrate into a capillary, as can be easily demonstrated in the laboratory. This has been misunderstood so often that it deserves emphasis. To improve capillary wetting, reduction of sur-

face and interfacial tension is not helpful but is at best a necessary evil associated with the reduction of contact angle.

Alkalies have been used as addition agents in studies of water-flooding by a numer of investigators. Use of soda ash has been recommended by the U. S. Geological Survey.[9] In this method a concentrated solution of soda ash was to be introduced previous to regular water flooding. The quantity used was intended to be such as to form a wall of solution at least a foot thick against the oil. About 600 barrels of nearly saturated soda ash solution per acre was recommended.[10] At the Pennsylvania State College, Mineral Industrial Experiment Station, 2 percent of soda ash solution was used in laboratory trials, with only a marginal increase in oil recovery. In field drives using soda ash solution, similar results were obtained, with occasional plugging of the sand.[1] Caustic soda is reported to be useless because when concentrated it attacks the oil and when diluted it becomes used up in a drive of but a few feet.[11]

In a laboratory study of displacement pressures, a 10 percent solution of soda ash was found to cause an increase in pressure of 36 percent in displacement of crude oil by water.[3] A similar concentration of caustic soda had nearly the same effect, increase in pressure being about 33 percent. Sodium Chloride, sodium sulfate, sodium acetate, and sodium tartrate had much less effect in increasing the pressure of displacement of crude oil by water. From these studies, Bartell and Miller concluded that no definite relationship exists between change in pressure of displacement, and change in interfacial-tension values between the two liquid phases. They suggested that effective displacing agents should be such as to alter the aqueous solution-silica interface either through a high degree of sorption or through chemical reaction at the interface. At a later date, Bartell stated that various alkaline solutions tried for promotion of the effectiveness of water-flooding gave negative results.[6]

Alkaline solutions were said to react with calcium and magnesium salts, producing precipitates which plugged the pore spaces. That soda ash, sodium silicate, and caustic soda solutions possess surface activity when used in this way, is shown by the fact that they reduced interfacial tension between crude oil and distilled water from 30 to about 20 dynes per cm.[20] A solution of silicious sodium silicate gave no evidence of increasing oil recovery over that of plain water.[1] Use of borax, soda ash, caustic soda, and sodium sulfite showed no appreciable differences in recovery from that of water alone.[19]

In addition to alkalies, surface-active agents have also been tested. Laboratory use of a 1 percent solution of soap gave unfavorable results although an additional quantity of oil was recovered. The amount of soap required for effectiveness was too great for field operations.[1] A combination of 1 percent of soap and 1 percent soda ash gave somewhat better results than use of soap alone. Oil was obtained as an emulsion in these tests. Soap would not be expected to have the same effectiveness in the field because of interference of calcium and magnesium salts.

In fairly recent studies[20] synthetic surface-active agents were tried in the laboratory. These included Aerosol OT, Span 80, Tween 61, and Alkaterge O. Aerosol OT is an anion-active agent extremely soluble in water and very high in wetting power. Span 80 and Tween 61, are both nonionic agents, the former being quite water soluble, the latter somewhat less so. Alkaterge O is a cationic agent which is oil-soluble rather than water-soluble. These were used as an 0.1 solution in oil. These compounds will reduce interfacial tension between oil and water. When these agents, dissolved in oil, were introduced before a water flood, less oil was recovered than when plain water was used alone. And, they were strongly sorbed on sand so that it is believed they would quickly disappear in use. These results agree with the theory as outlined. In fact, cation-active agents interfere with the wetting of glass by water. This has been found a disturbing factor in some of their commercial applications.

Requirements for an Ideal Agent

In view of both theory and experimental results an agent which would increase the effectiveness of a water drive should meet the following requirements:

- It should lower the contact angle as measured by a drop of solution under oil on quartz.
- In solution, it should have a high interfacial tension against crude oil.
- The solution should be low in emulsifying power so that the agent would not be used up in producing an emulsion rather than in effecting the sand-aqueous solution interface.
- It should be unreactive with impurities in the oil sand such as calcium, so as not to form precipitate and clog the pores but may react to produce a soluble more efficient agent.
- It should be neither strongly acid nor strongly alkaline so as not to react with constituents in crude oil, as this would tend to cause them to dissolve in the oil.
- It should be inexpensive because of the large quantity needed in the field.

Laboratory Methods

Measurement of contact angles on glass should be a very useful approach as a preliminary means of evaluation of agents for probable usefulness. All agents which do not give a low contact angle of solution on glass under oil could be screened out. Interfacial-tension measurements should be of use. All agents could be screened out which markedly lower interfacial tension in aqueous solution against crude oil.

It should be a simple matter to develop a modification of the preferential wetting test described for use with cotton fabrics.[13] The time required for a definite weight of oil-soaked material to sink through the sample solution could be measured. The use of silica foam in place of the usual dense sand offers possibilities provided air has been displaced from its capillaries by the oil. By using the same silicious material and a number of solutions of different agents simultaneously, relative results could be obtained. Also the Bartell displacement cell technique is well suited to measurement of displacement of oil by water. These simple physical tests should be useful in furnishing preliminary information, previous to a more elaborate trial comparable to that with sand cores as developed at Pennsylvania State College.[1]

Such agents as prove promising in the laboratory could be tried in the field if cost and other considerations of a practical nature were favorable. It is suggested that a fairly concentrated solution in water should be most advantageous, since no agitation is possible. Any agent which would be effective in causing preferential wetting of sand would be sorbed to some extent on the surface of the sand. This follows from a study of the nature of detergency. Although the conditions in an oil field are quite different from those in the laundry or in textile processing, the fundamental principles of surface chemistry also apply. On the basis of results

■ CONTINUED ON PAGE 196

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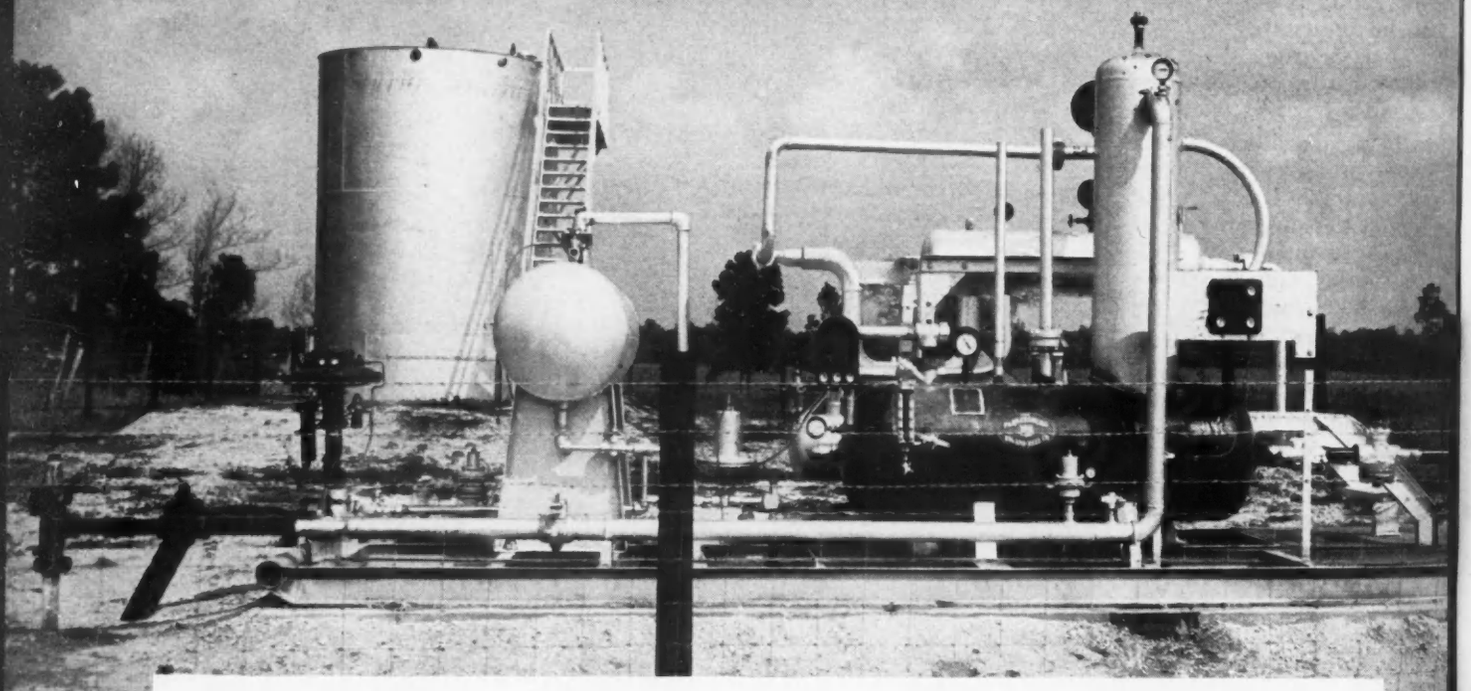

Data provided by this direct test of the old versus the new in condensate recovery methods further substantiates the revenue-increasing performance of the Parkersburg Hyreco Processing Unit. Tests were made under identical operating conditions on the same well, by alternately flowing it through the Hyreco and then through the heater-separator hook-up.

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Removal of Water and Emulsion Blocks To Stimulate Oil Production

By WAYNE F. HOWER

Halliburton Oil Well Cementing Company, Duncan, Okla.

Part 2—CONCLUSION

FIELD application of the aromatic sulfonic acid is simple. The general rule is to thoroughly disperse one gallon of the chemical in two barrels of a clean, untreated, light crude oil or diesel fuel for each foot of formation being treated. This dispersion is pumped into the blocked formation and displaced with an equal volume of oil. The well is usually held in a static condition for only one to two hours and then brought back on production. The amount of chemical may be increased when it is known that large amounts of water have been lost to the formation.

Oil is used as a carrier for the chemical instead of water to prevent flooding the formation with the constituent causing the blocking. It also makes it possible to bring the active chemical in contact with the water or emulsion in a concentrated form without pumping large amounts of the material. Since it is present as an unstable dispersion, conditions are ideal for the water or emulsion to contact the chemical and remove it from the oil carrier. The surface tension of the water is immediately lowered and the emulsions are quickly broken. Slight variations in the pumping and displacing procedure may be necessary under the great variety of conditions found in oil fields.

A dirty or wet oil should not be pumped into the formation. A treated oil may retain part of the emulsion breaker used in its treatment on the surface. The combination of this breaker plus the aromatic sulfonic acid may give a mixed stabilizer that will cause new emulsions to form instead of breaking them. A simple test will prove whether the treated oil may safely be used as the carrier.

It is easily seen how the water soluble aromatic sulfonic acid contacts and breaks an oil-in-water emulsion. Since this chemical is oil insoluble, it would be rather difficult to visualize its contacting the inner or discontinuous phase in a water-in-oil emulsion.

There is a great deal of turbulence when the chemical dispersion is pumped through the small emulsion-clogged pore spaces in the formation. This turbulence can develop a contact of the water with the aromatic sulfonic acid and commence the coalescence of the two liquids. In addition, it is believed there is always a small amount of the oil-in-water type of emulsion in the water-in-oil emulsions. When the oil-in-water emulsion is broken, the static equilibrium of the two types of emulsions is disrupted which causes more of the oil-in-water type to be formed. This chain reaction can continue until all of the emulsion is broken.

Some chemicals break a variety of emulsions efficiently when used in small amounts. Since it is impossible to ascertain the amount of water or emulsion being treated in a formation, these chemicals were added in excess to the two fluids after the emulsion was broken. In many cases, a new and stable emulsion has been formed. One chemical was carefully checked with both an oil-in-water emulsion and a water-in-oil type. Addition of an excess of this chemical completely neutralized the effect of the original stabilizer to form new emulsions and to control the type of emulsion formed.

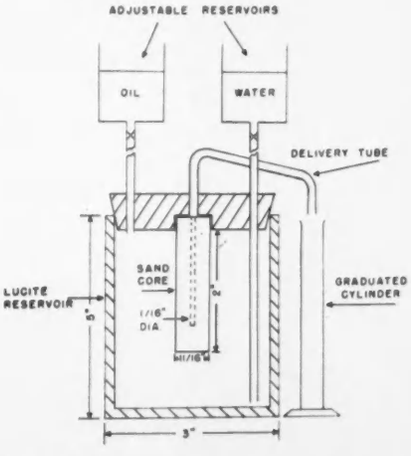

FIGURE 4. Diagram of flow test apparatus used to determine the effect of the aromatic sulfonic acid in removing connate water and in breaking water blocks in sand bodies.

Removing Water Blocks

A further study was made with the chemical to determine its properties in removing water from sand formations. Figure 4 describes an apparatus used. The sand core was inserted in the neoprene rubber stopper which was in turn securely placed on top of the lucite reservoir. Oil and/or water was placed in the reservoir by a manipulation of the adjustable reservoirs shown at the top of the sketch. These reservoirs were raised or lowered at will to cause desired pressure to be exerted on the sand core and thus govern the flow of fluids through the system. By manipulation of the valves and the reservoirs, one fluid was displaced by the other and any desired fluid interface level maintained in the lucite reservoir.

The naturally consolidated sand investigated had a permeability of 1400 millidarcies and a complete absence of bedding planes. The cores were drilled to have an active length of two inches and a diameter of 11/16-inch. A 1/16-inch hole was drilled longitudinally through the center to within 5/16-inch of the bottom of the core. Cores to be saturated with water were placed under water and a vacuum placed on the container. The vacuum was applied and released several times to remove all the air and thoroughly saturate the sand with water.

Crude used in the tests had a viscosity of 5.4 centipoises at 78° F. and an API gravity of 36.3 degrees. The water had a viscosity of 0.999 centipoises, a specific gravity of 1.040 at 78° F. and contained 56,700 parts per million total solids.

Laboratory Procedure

To determine the effect of the aromatic sulfonic acid on the flow of oil

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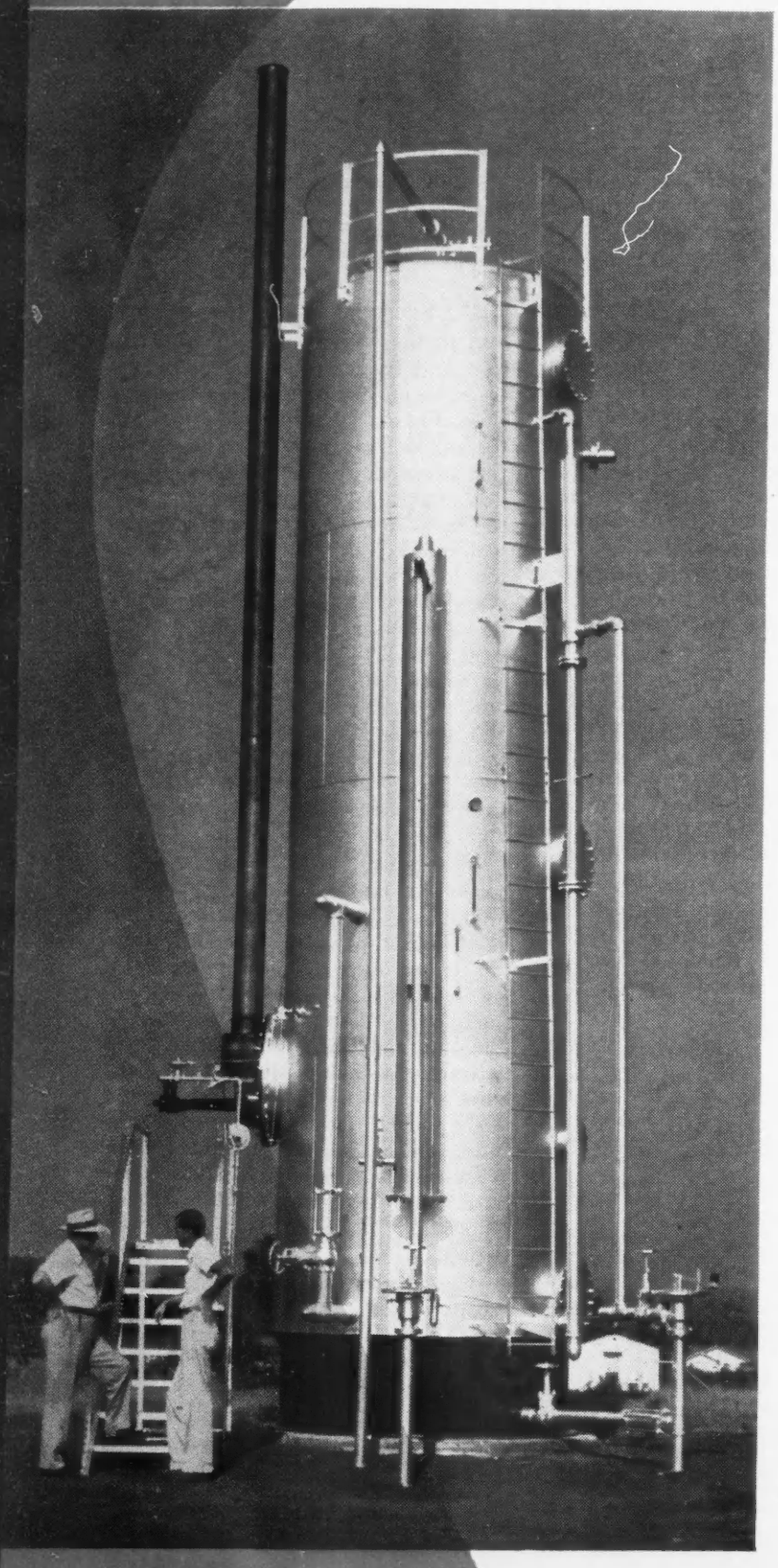

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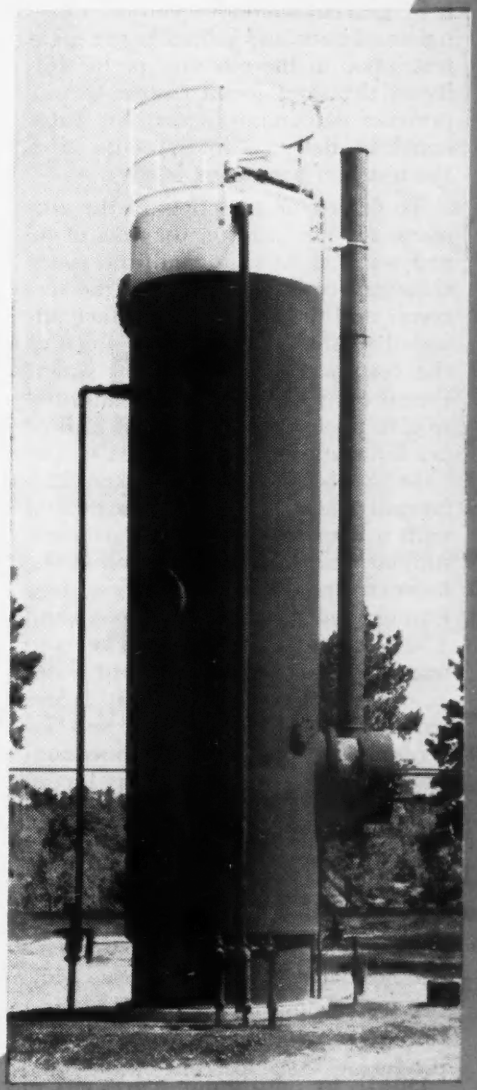

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through a sand containing connate water but producing no formation water, the water-saturated core was placed in the apparatus and oil flowed through the core until a steady rate was attained and no more water was produced. Thirty percent of the saturating water remained in the core and can be considered connate water. At this point, oil was flowing through the apparatus at the rate of 18.6 cubic centimeters per hour. The delivery tube was removed from the neoprene stopper and a dispersion of 0.5 cubic centimeters aromatic sulfonic acid in 10 cc crude oil was forced slowly into the core. Production of oil was resumed to show an oil flow of 30 cc per hour after a small amount of water was produced. This flow showed a 61 percent increase over the original conditions and indicates the great restriction in the effective permeability of the sand to oil caused by the presence of connate water. No water could be detected in this core after the test had been completed.

To determine the effect of the aromatic sulfonic acid on the flow of oil and water through a sand, the water saturated core was placed in the reservoir and the oil-water interface adjusted so that the lower one-third of the core was surrounded by water. Pressure on the system was adjusted to give a steady flow of oil of 22.8 cc per hour and of water at 6.84 cc per hour. Such a system produced 23.1 percent water. The core was treated with a dispersion of 0.5 cc aromatic sulfonic acid in 10 cc crude oil in the manner described in the first test. Equilibrium flow was 33.9 cc oil and 2.724 cc water per hour. The core was producing only 7.5 percent water as compared to 23.1 percent before treatment, and the oil flow was increased 48.5 percent. Flow was continued under these conditions for an extended period with the water content gradually increased to 8.05 percent. At this point, 10 cc of the water was forced into the core in the same manner as the aromatic sulfonic acid dispersion. Oil flow was then 7.5 cc per hour, or 68.7 percent less, while the water flow increased 25 percent to 3.42 cc per hour. The system was producing 31.3 percent water and seemed to be partially water blocked in the upper section of the core. A retreatment with the chemical increased the oil flow to 34.02 cc per hour and decreased the water flow to 1.44 cc per hour. The system was then producing 95.95 percent oil and 4.05 percent water. Final flow of oil was slightly increased over the flow delivered prior to the injection of water into the core. The final flow rates represented an increase in oil flow of 49.2 percent and a decrease in water flow of 79 percent as compared to the original conditions.

Effect of the aromatic sulfonic acid on the flow of oil through a sand body that is completely devoid of water was determined. The core was saturated with the oil, placed in the reservoir and oil was produced until a constant rate of 29.4 cc per hour was obtained. Treatment with the 0.5 cc aromatic sulfonic acid in 10 cc oil dispersion followed. A new flow rate of 33.6 cc per hour or an increase in oil production of 14.3 percent was obtained. The sand, before being saturated, had been cleaned thoroughly and was dry. Since this sand was of the type that was preferentially water wet, some of the highly polar aromatic sulfonic acid was certainly absorbed by the individual sand grains. The wettability characteristics of the grains may be changed thus changing the angle of contact of the oil with the sand. In addition, new flow channels may be opened to the flow of oil, thus increasing the over-all productive capacity of the sand body. This theory ties in with some experimental results wherein the porosity determined by saturating sand cores with liquids varies somewhat with each liquid used for the measurement.

These tests clearly show that the connate water adjacent to the sand can be completely removed by the use of the aromatic sulfonic acid thus increasing the effective permeability of the formation sand to oil. The decrease in production of oil, especially in formations containing a high percentage of connate water, can easily be due, in part, to an accumulation of the connate water in the area surrounding the well bore. If a careful study of the well indicates this condition, an application of the chemical should increase oil production.

It was also possible to obtain a more favorable oil-to-water ratio by this treatment. The desirable effect caused by the chemical is long lasting but there is an indication that the percentage of water being produced will gradually increase with time. The elapsed time before the original oil-to-water ratio is again obtained will vary for the rate of production and the peculiarities of each formation. The marked decrease in oil production when the sand core was "flooded" with water shows the effectiveness of the water block.

These tests do not include the effect of the chemical on sands that are producing more water than oil. The results from field applications are varied and no correlation has been possible. One striking example of a successful treatment is a well that was producing 11 barrels of oil and 52 barrels of water per day. One week after treatment, the well was producing 42 barrels of oil and 3 barrels of water per day while eight months after treatment, the oil had increased to 48 barrels with the water remaining the same.

This aromatic sulfonic acid is also a good mud dispersant and is effective in removing lost mud from a permeable formation. The nature of the application prevents an appreciable dilution of the mud. This factor prevents the complete removal of large quantities of mud, but numerous reports state that a quantity of mud has been flushed from the formation after a treatment with this chemical. The permeability of the formation, the type of mud used during drilling, and the condition of the mud are factors that govern the results that will be obtained. The removal of even a small quantity of mud will open new flow channels that may be widened as the well is being produced.

Use in Completions

This process may be used to advantage during different phases of the life of a well. It is applicable as a completion procedure in areas where difficulty is encountered in bringing the well on production. Water loss from drilling mud can form an efficient water and/or emulsion block in many formations. In many instances a formation had given a good test but failed to produce properly. This was particularly noticeable where the well was deepened after the test and mud had been in contact with the formation for an extended period. Reduction of the surface tension of the water also reduces the Jamin effect which means less resistance to flow where gas and fluid are intermingled in capillary channels.

The intrusion of water in low permeability and highly bentonitic sands presents a more difficult and different problem. The new treatment does not seem to be applicable in this type of sand as negative field results have been obtained. The fine bentonitic particles that are swollen by the action of the intrusion water are not appreciably changed by the action of the chemical and the formation remains "swollen" shut as before.

A new chemical mixture is being studied that shows promise in the treatment of the bentonitic sands and

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in the removal of large quantities of mud from permeable formations. This mud dispersant is a mixture of the aromatic sulfonic acid and dilute hydrochloric acid. The base exchange on the bentonite, brought about by the action of the hydrochloric acid, causes it to loose some of its affinity for water. The mud or bentonite releases some of its adsorbed water, thus taking up less space, and would become hard if it were not for the dispersant action of the aromatic sulfonic acid. The combination of these two chemicals actually shrinks and disperses the hydrated mud at the same time, thus removing the mud and reopening flow channels in the oil producing formation.

Other Applications

There are many instances during the life of a well when water can contact the oil bearing formation. Casing leaks are frequent in some areas while workover jobs in low pressure wells often cause a decrease in production.

This product can be used as a last resort application on old wells producing an uneconomical amount of oil. A treatment with the aromatic sulfonic acid is recommended to determine the true condition of the producing formation before it is abandoned.

This process has been designed and the chemical selected to alleviate conditions caused by the intrusion and presence of water in oil bearing formations. These conditions are water and/or emulsion blocks. Therefore, it is advisable to make a careful study of the well and its past history before considering the possibility of results from the use of the aromatic sulfonic acid.

ACKNOWLEDGMENT

The author extends appreciation to the Halliburton Oil Well Cementing Company for permission to publish this paper, and to Warren Ostroot and Joe Ramos for their valuable aid in the development of the process.

(Last of Two Parts)

Surface Activity as Applied to Secondary Production

■ CONTINUED FROM PAGE 189

on preferential wetting of oil-soaked cotton,[13] molecularly dehydrated phosphates appear promising. Research with these and other materials which meet the physical-chemical requirements might well lead to productive results.

Estimates as to Practicability

In the ideal case, a solution of surface-active agent in water flooding must as a minimum produce a sorbed layer of the agent one molecule thick over the surface of the oil sand. Likewise, in the ideal case, all of the oil would be displaced. Assuming a specific value for the oil, one should calculate the cost which would be allowable for the surface-active agent, if it were of such enormous efficiency. Without calculation, it is clear that this will be many dollars per pound, the calculation is only to show how many.

After such a preliminary, it is then desirable to make more practical estimates on various bases. A typical one would be that the sorbed layer, allowing for losses of various kinds, would be 50 molecules thick and the oil recovery 50 percent efficient. With the right agent, properly applied, that is pessimistic. Displacement from the sand by the right agent to an efficiency of 100 percent can be closely approached. Of course, some of the oil will be lost by entrainment; how much is a basis for enlightened guessing. The ideal agent has probably not yet been produced. Its general structure should be predictable from the performance of known surface-active agents in physical-chemical tests. Its specific structure would be derived from synthesis and experiments with the compounds predicted, taking them in homologous series.

Looking Ahead

It is highly improbable that a cure-all will be found. One is operating at an interface ranging from pure calcium carbonate to pure silica as extremes, with oils ranging from pure straight chain paraffins as one extreme to naphthenes as the other. Naturally, the extremes are distantly approached as limits rather than reached. Modifications of the agents if not use of even different types will necessarily be applied.

Examples can be cited of two somewhat parallel problems which are solved as evidence that it can be done. Greasy and dirt-soiled metal can be commercially spray-cleaned with a cleaner which gives a final metal surface perfectly wet by water —one having no water break. The same metal surface can be spray-cleaned with a diphase cleaner which removes the dirt at least as well to give a clean metal surface with a sorbed layer which repels water. With oil sands, the mechanical factor of spray application is absent but the same degree of perfection in the end result is not required.

As a second example cotton is treated with two surface-active agent solutions. In one case its surface is clean and remains with the negative properties of cotton. In the other case its properties are profoundly altered, it has now a positive charge. No extensive mechanical action is required. As another version of that same problem, a piece of light cotton cloth wet with lubricating oil passes from a lubricating oil layer into an aqueous layer under the influence of gravity alone in less than 20 seconds. That at least approaches the conditions desired, differing only in the substrate. Probably the same agent will not be efficient on oil sand as on cotton but some other agent should be.

In both cases, the charge on the surface has been correlated with a proper form of charge on the polar-nonpolar molecular structure applied to alter a surface profoundly so that what it formerly attracted is now repelled. As a simple statement of the problem here, a surface-active agent which would plate the boundaries with a layer at least one molecule thick to cause it to repel the particular type of crude oil in that field would provide additional oil through water-flood operations.

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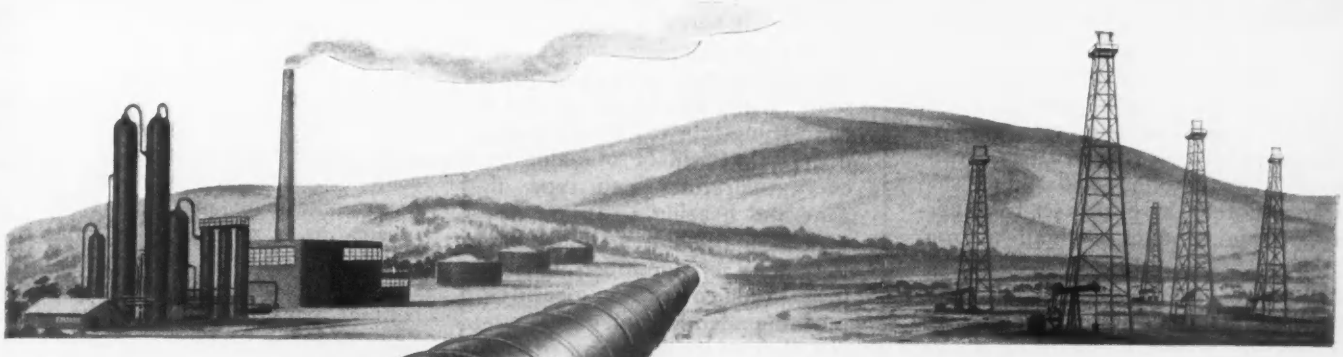

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Lubrication and Pumping Unit Speed Reducer Life

By KENNETH N. MILLS

Mechanical Product Manager, International Derrick & Equipment Company, Columbus, Ohio

EFFECTS OF lubrication on the life of speed reducers used in oil well pumping unit service are discussed. The author presents some fundamental facts concerning lubricating speed reducers that will be of value to every operator. Each type of gear and bearing wear are described in such a manner that they may be identified in the field, and corrective measures recommended in each case. Factors that effect lubricants in this type service are discussed, and suggestions are made as to the lubrication program for oil well pumping units.

THE quantity, condition and load-carrying capacity of the lubricant used in a pumping unit speed reducer can have a material influence on the service life of the reducer. The lubricant in a speed reducer must serve a multitude of functions. It must prevent metal contact between rolling and sliding surfaces, protect these surfaces from corrosion, and conduct friction heat from these working surfaces. Each of these functions must be carried out under rather adverse conditions, which are the result of wide temperature fluctuations. These temperature variations create wide variations in viscosity and are conducive to the accumulation of moisture from condensation inside the reducer housing. As the lubricant is continuously aerated by the gear tooth action, it must have high resistance to oxidation, because the products of oil oxidation are usually corrosive.

Lubricant Purpose

The basic purpose of the lubricant is to prevent metal-to-metal contact between rolling and sliding surfaces. To fill this requirement it must have sufficient film strength to resist the imposed loads, and this film strength must be maintained over a wide range of temperature. As the film strength of a lubricant varies with temperature, the quantity of lubricant reaching the contacting surfaces must be sufficient to keep the oil temperature at the point of contact below some critical value. If the temperature of the lubricant at the contacting surfaces exceeds this critical value, it will fail and excessive wear will occur. All geared speed reducers contain mechanical elements employing both sliding and rolling contact. Normally, the most critical condition is found in the gear teeth. The nature of the motion between the mating gear teeth is rather complex, and it involves a mixture of rolling and sliding. The magnitude of the sliding action between mating gear teeth is dependent on the design of the gear teeth and the gear ratio. The variation in sliding velocity with contact position is shown diagrammatically in Figure 1. In this illustration it will be noted that the sliding velocity is a maximum at the base of the tooth and decreases as the contact point approaches the pitch line. After the contact point passes the pitch line, the sliding velocity increases. The direction of this sliding action is away from the pitch line on the driver and toward the pitch line on the driven member.

When the true nature of the motion between mating gear teeth is recognized, it is apparent that excessive tooth wear will occur if the lubricant does not have sufficient film strength to support the applied load. The magnitude and nature of this wear will depend on the extent of the oil film breakdown. Some normal variations in the gear tooth profile will create oil film loads in excess of the theoretical value and may cause partial oil film failures. Gear tooth profiles are not perfect theoretical involutes, and the tooth surfaces are not perfectly smooth. Each of these conditions may cause momentary failures of the oil film. This will cause highly localized wear, as the oil film will be re-established when the point of contact has moved to a more advantageous location. Tooth profile errors and small errors in tooth spacing will create high dynamic loads. These high instantaneous dynamic loads can cause limited wear. In these borderline cases, the wear will be of an abrasive or rubbingoff nature, and the first signs of wear should appear in the zones of maximum sliding. When teeth wear in this manner fine metallic particles will be liberated. If

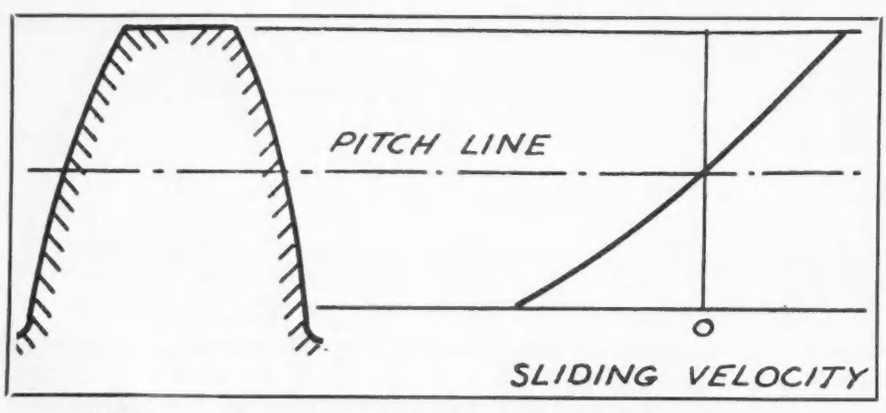

FIGURE 1. Variation in siding velocity with contact position of the gear tooth.

these particles are not removed from the lubricant the rate of wear will be accelerated by the abrasive action of these particles. If these particles are removed from the lubricant, this type of wear may be self-corrective, and cease when the offending surfaces are worn off.

Tooth Surface Failure

In more extreme cases of oil film failure, the tooth surfaces will deteriorate at an accelerated rate, and they will start to weld together. This type of tooth surface failure is known as scuffing, scouring or galling. A drastic example of this type failure is shown in Figure 2. In its early stages this type failure will appear as radially scored grooves starting at the base of the tooth and running toward the pitch line. The edges of these scores form additional high points to puncture the oil films and cause additional local welding. As this surface roughness increases the friction forces, it creates local points of high temperature which decreases the load capacity of the oil film. If the metallic particles resulting from this type of wear are not removed from the lubricant, they will accelerate the rate of wear. In some cases this type of gear tooth wear can be prevented by using lubricants with higher film strengths. However, in the more critical cases a mild, extreme-pressure lubricant must be used. These lubricants contain agents which form anti-welding films on the tooth surfaces and materially increase their resistance to galling or welding. If a failure of this type is detected in its early stages, it is highly probable that the gears can be salvaged by cleaning the metallic cuttings from the housing and changing the lubricant to a mild, extreme-pressure lubricant.

Experience has shown that the phenomenon commonly known as pitting is influenced by the film strength and cleanliness of the lubricant. Pitting of gear teeth has been classified in two categories. While the conditions causing these two types of pitting are identical, the end results are different. Initial pitting can be classified as a corrective procedure which occurs during the wearing-in process and disappears in the course of normal wear. In the case of progressive or destructive pitting, which usually accompanies overload, the pits increase in number and size until the tooth profile is destroyed.

Buckingham[1] has explained the phenomenon of pitting as a result of plastic flow of the surface of the tooth and subsurface shear stresses resulting from the tooth action. Plastic flow of the surface layer of the gear tooth results from the combination rolling and sliding motion between the mating gear teeth. This action causes the surface layer to travel in the direction of sliding or rolling. This plastic movement of the surface layer can be produced by pure rolling, and the surface will flow in the direction of rolling. In this case the material tends to travel as a wave in front of the roller, as shown in Figure 3. Naturally, when sliding exists in combination with rolling and its direction is the same as that of the rolling, the rate of surface movement will be increased. This plastic flow of the surface layer work hardens the surface layer and increases its resistance to plastic flow. This action tends to develop surface cracks and the repetition of tooth action causes these cracks to inflict additional damage. If the lubricant becomes trapped in this crack, it will tend to lift out small particles of the material and develop small surface pits. This type of pitting is usually called initial pitting and is not detrimental if the rate of surface strengthening from the working is sufficiently rapid to arrest the surface cracking process.

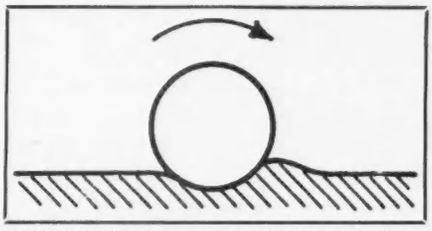

FIGURE 3. Plastic movement of the surface layer in pitting can be produced by pure rolling or a combination rolling and sliding motion between the mating gear teeth.

Excessive Tooth Loading

If the tooth loading is excessive, the high subsurface shear stresses resulting from the contact between the curved tooth surfaces will develop subsurface cracks parallel to the surface. If this process is accompanied by the development of surface cracks, the conditions required to produce progressive or destructive pitting are established. The subsurface cracks, and the process which produced the small pits will be repeated on an expanded scale. In this case the pits will be larger and deeper. This destructive process will proceed at a rapid rate, and the tooth profile will be destroyed, if it is not arrested. Some recent research work[2] on the pitting of tractor gears has shown that dirt in the lubricant can cause pitting.

A typical case of progressive pit-

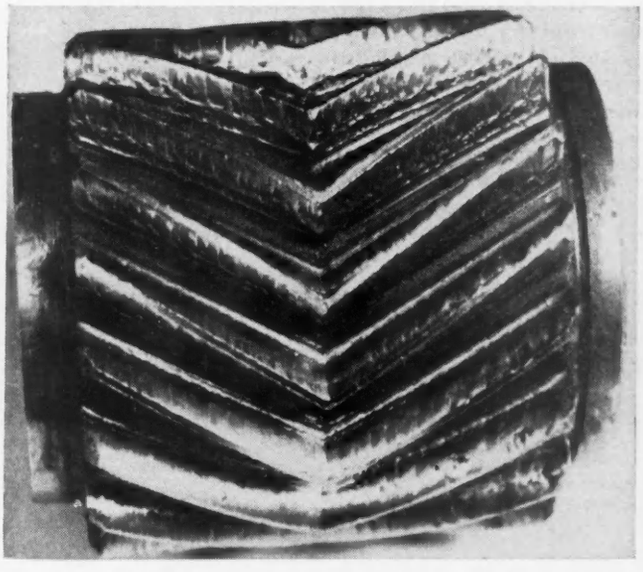

FIGURE 2. Example of accelerated deterioration of gear tooth surface, known as scuffing, scouring or galling.

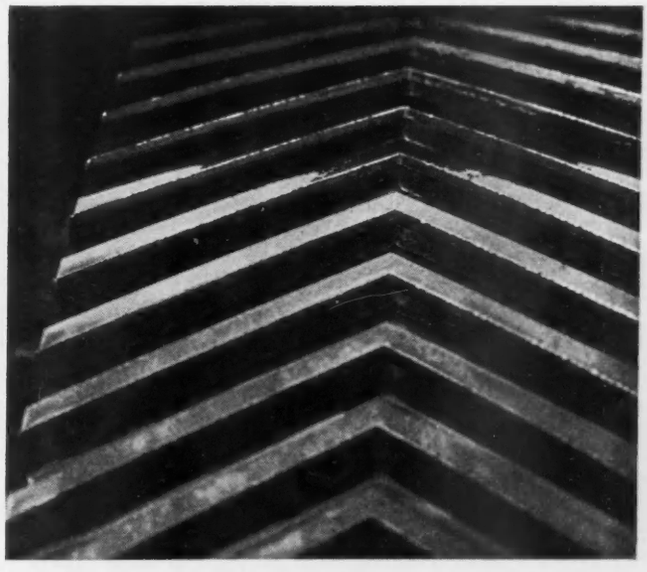

FIGURE 4. This photograph illustrates a typical case of progressive pitting resulting from severe overload.

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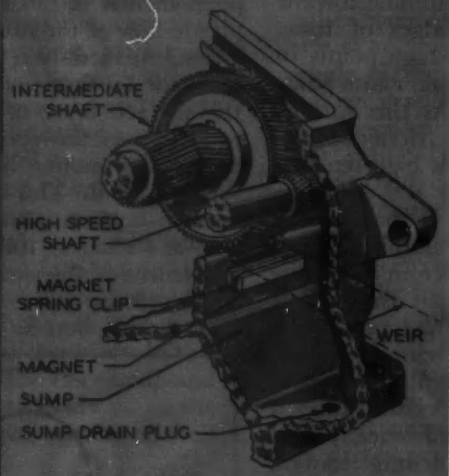

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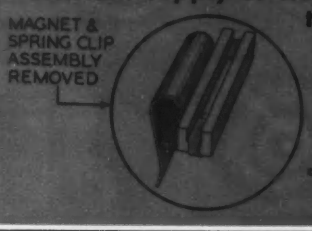

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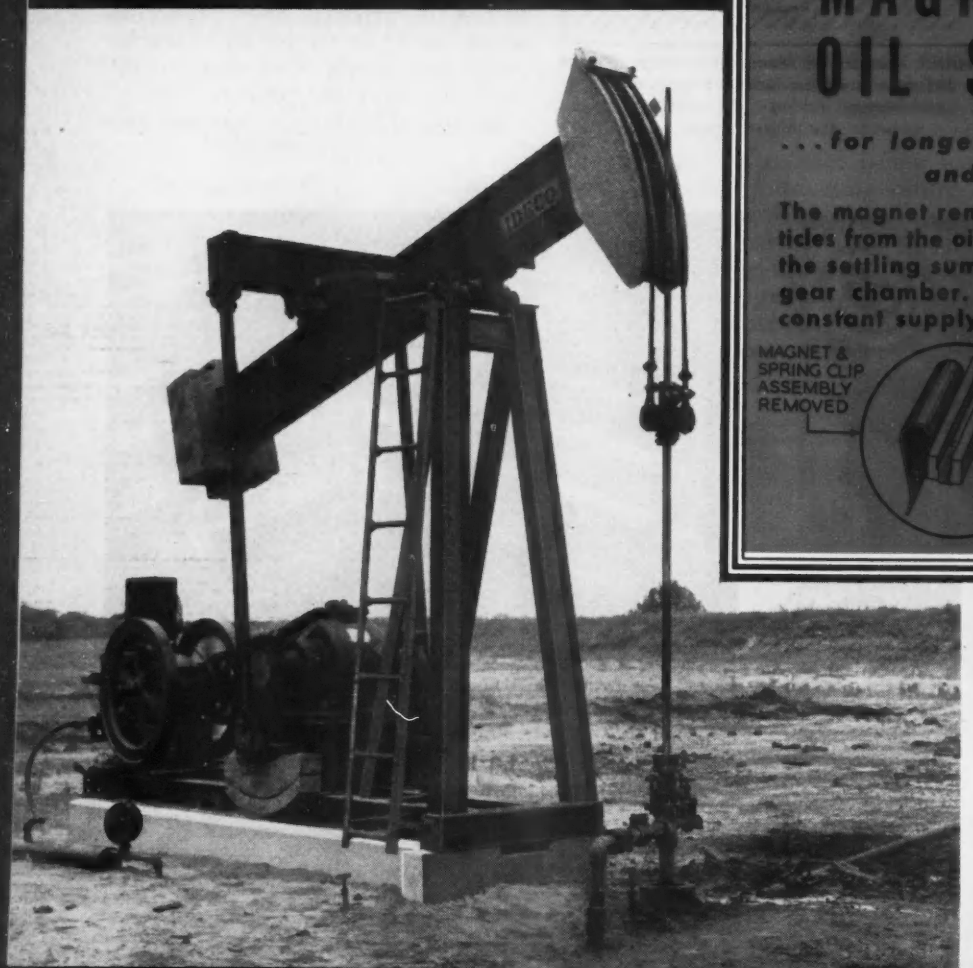

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ting resulting from severe overload is shown in Figure 4. In this illustration, which shows the condition of the gear, the pitting is confined to the area of the tooth profile located below the pitch line. The pinion teeth in this reducer were severely pitted, and the pitting was confined to the area below the pitch line. This condition is characteristic of the gears and pinions used in pumping unit speed reducers. Experience has shown that the resistance of gear teeth to pitting can be materially increased by using a mild E. P. (extreme pressure) lubricant. This type lubricant has a higher film strength than a straight mineral oil, and it increases the resistance of the gear tooth to galling. If a speed reducer is loaded to capacity, a lubricant of this type is desirable, as it will increase its capacity to resist the added loads resulting from engine impulses and other indeterminate loads.

Speed Reducer Lubricants

As the design of all pumping unit speed reducers is such that the same oil is used to lubricate the gears and bearings, its characteristics must be well suited to both elements. Experience has shown that a lubricant which has sufficient film strength to support the gear loads is satisfactory as a roller bearing lubricant, if it is noncorrosive, and will flow to the bearings. Due to the precision nature of roller bearings and the basic nature of the action between the rollers and their raceways, they are more sensitive to foreign materials in the lubricant than gear teeth. However, the foreign materials which are harmful to bearings also adversely affect the service life of the gears. The usual detrimental foreign material found in speed reducer lubricants are dirt, metallic particles, water, acids from oil oxidation, and dissolved corrosive gases from the atmosphere. From the nature of these foreign elements it is apparent that their concentration in the lubricant will increase with service. As some of these materials are the result of chemical action, the oil must be changed to remove these materials from the reducer, as they can not be removed by filtration or settling.

The majority of these adverse foreign elements produce the same general type of damage to roller bearings. However, the mechanics of the process causing the damage is different. If dirt or grit enters the lubricant, it will act as a lapping agent and cause the rolling elements in the bearing to wear at a rapid rate. The inner bearing race shown in Figure 5 was damaged by abrasive wear. In this illustration it will be noted that the diameter of the race has been materially reduced in the roller pathway by abrasive wear. As a result of this wear the internal clearance in the bearing became excessive, and it failed to hold the gears in their proper location. Laboratory tests on roller bearings have shown that, when a roller bearing is lubricated with a clean, noncorrosive lubricant, it will fail from surface fatigue, and the metal loss due to abrasive wear is insignificant. When a bearing fails due to surface fatigue, the rolling surfaces become pitted as shown in Figure 6.

Corrosive Agents

Corrosive agents in the lubricant can cause a material reduction in roller bearing life. The most harmful type of corrosive agents found in oil is acid due to oil oxidation. Basically, oil oxidation is caused by the aeration of the oil, resulting from the churning and kneading action of the gears on the oil. If the oil is contaminated with metallic particles from normal gear wear, this action may be accelerated by these particles. Some of the products of oxidation are corrosive to steel, and they will attack the bright metal surfaces of the bearings. This corrosive attack will cause two types of bearing wear. First, the

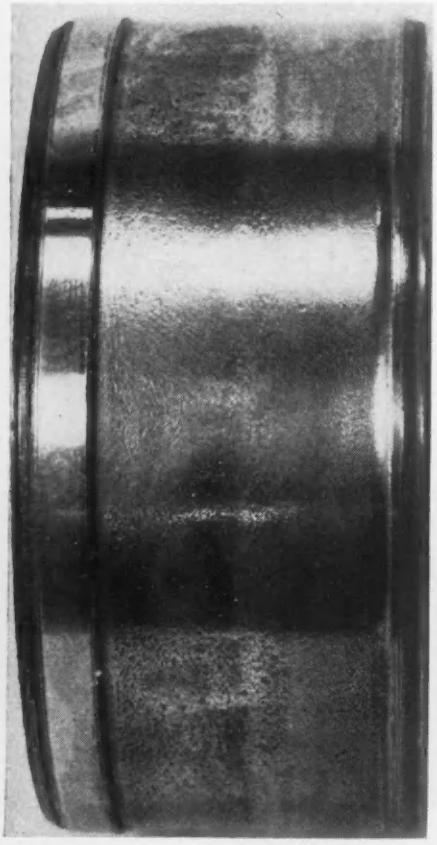

FIGURE 5. Inner roller bearing race damaged by abrasive wear due to dirt or grit in lubricant.

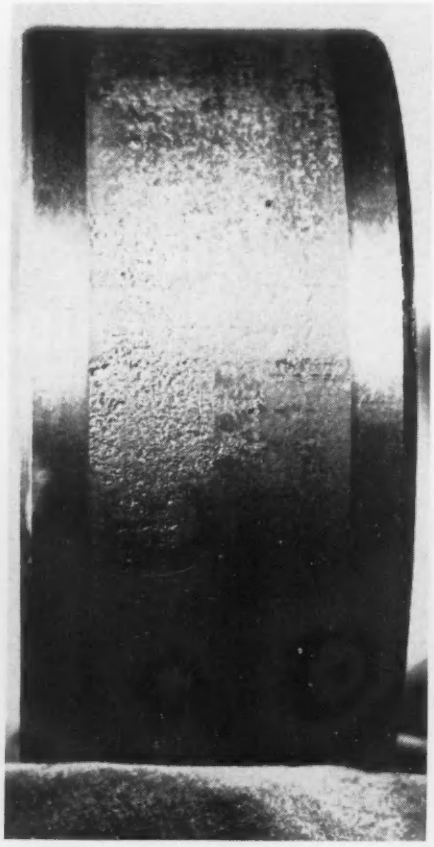

FIGURE 6. Rolling surfaces of a bearing pitted when bearing failed due to surface fatigue.

FIGURE 7. Inner race of this bearing was damaged by corrosive particles in the lubricant.

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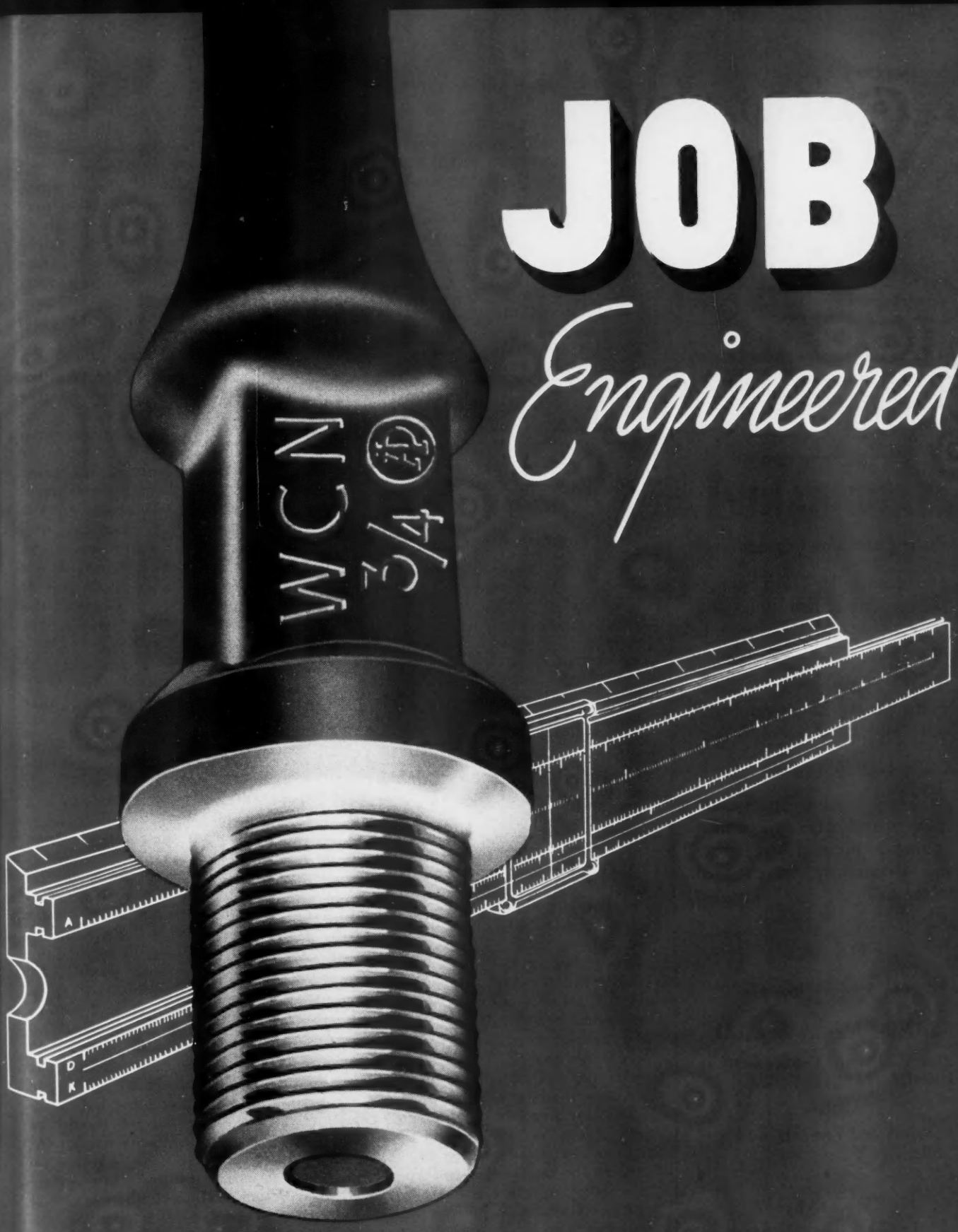

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corrosive agent will etch metal from the bearing surfaces, and this will produce an oxide film on the surface. This oxide film will be worn away, exposing new clean metal to the corrosive agent. The oxide film removed from the bearing surface is abrasive, and it will cause abrasive wear which will speed up the rate of bearing deterioration. The bearing inner race shown in Figure 7 was damaged by corrosive wear. In this illustration it will be noted that the area in the roller pathway is worn below the adjacent surfaces, and the surfaces outside the roller pathway are badly pitted from corrosion. When this bearing was removed from service, the areas outside of the roller pathway were covered with sludge, and the area in the roller pathway had a dull gray appearance, which is characteristic of lapped surfaces.

Moisture Accumulation

Corrosive bearing failures can be caused by moisture in the lubricant. The usual source of water in speed reducer housings is condensation, and in the case of heavily loaded reducers operating in damp areas, moisture can accumulate inside of the reducer housing at an astounding rate. If a speed reducer is heavily loaded, the energy required to overcome friction will raise the temperature of the air inside of the reducer to a level above the housing temperature. If the air inside of the speed reducer housing is moisture laden, the moisture in this hot air will condense on the colder walls of the reducer housing, and run into the oil sump. Moisture can accumulate in lightly loaded reducers when rapid changes in outside air temperature are encountered if the air is moisture laden. If the water concentration in the oil passes some critical value it will reduce the film strength of the lubricant sufficiently to cause the gears to gall and wear at an excessive rate.

As changing air temperatures create air circulation in the speed reducer housing, it is reasonable to expect the oil to become contaminated with any gaseous materials which may exist in the outside air. Several years ago the writer examined several oil samples from reducers operating in sour gas areas to determine their acid content. Some of these oil samples were found to contain about 17 times the maximum allowable acid concentration for a satisfactory roller bearing lubricant. This would indicate the need for more frequent oil changes in areas where the atmosphere is contaminated with corrosive gases.

Viscosity of the lubricant to be used in a reducer is dependent on the prevailing temperature condition. When extreme temperature variations exist between summer highs and winter lows, it will be necessary to change oil viscosities with the seasons. If this practice is not followed, the oil which is suitable for winter operation may not have sufficient film strength to resist the gear tooth loads during summer operation. If the summer grade oil is used during winter operation, it may channel and not provide proper lubrication to the gears and bearings.

The type of lubricant to use in a reducer is dependent on the ratio between reducer capacity and reducer load. If the reducer is loaded above approximately 75 percent of its rated capacity, a mild E. P. type lubricant is desirable as it will provide additional film strength to resist indeterminate loads. If it is loaded to less than 75 percent of its rated capacity, a well refined, straight mineral oil should give satisfactory service. If examination of the gear teeth reveals signs of insufficient film strength, the lubricant should be changed to a mild E. P. type lubricant.

Oil Changes

As the lubricant used in a speed reducer can be subjected to a wide range of adverse conditions, it is reasonable to assume that the time between oil changes should vary with the presence of these conditions and the ability of the lubricant to resist these conditions. The time interval between oil changes can be determined by chemical checks of the oil or by arbitrary rules based on experience. Due to the complicated nature of chemical oil checks, the "rule of thumb" method is usually used to determine when the oil should be changed. If the reducer shows signs of excessive moisture accumulation or is operating in a contaminated atmosphere, the oil should be changed at regular intervals of approximately six months. If the reducer is operating in a dry area and is not subjected to adverse conditions, the oil should be changed once each year to remove the products of normal wear from the reducer. If these products are not removed they will accelertae the rate of wear. When the oil is changed, the interior of the gear case should be cleaned and flushed with a light flushing oil. If this practice is followed, it will pay off in decreased maintenance cost and down time.

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[1] Operational Stresses in Automotive Gears, by Earl Buckingham. Presented to 1950 Summer Meeting SAE.

[2] Gear Testing Methods for the Development of Heavy Duty Gearing, by R. P. Van Zandt and B. W. Kelley. Presented to 1949 Semi-Annual Meeting AGMA.

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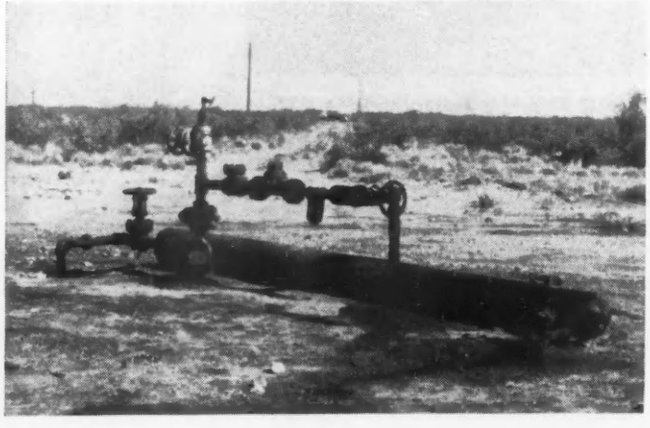
The pump is then started and the daily allowable pumped with a short, slow stroke so as not to uncover the bottom of the tubing or the face of the sand. By keeping the sand "soaked" with oil and handling the gas separately from the well, over a period of months the ratios are materially reduced.

Difficulties encountered with this method are: (1) The polish rod stuffing box continually runs hot because of the small volume of fluid handled, and because it must be kept tight in case the well begins to flow. (2) The choke on the casing, having a high upstream pressure, is continually freezing up. Both of these conditions are overcome by piping a small amount of water from the fresh water system to the choke. One connection goes to a funnel placed around the stuffing box (not shown) and the other to the upstream side of the choke (shown). These remedies effectively overcome the troubles and the production is obtained at a lower ratio. However, there are several problems inherent in this type of operation and close supervision is required.

HOW TO—Scrub Injection Water for Flood Project



Injection water for water flood projects is treated, filtered and refiltered, but rust and scale from the lead lines carrying the water to the input wells may still clog up the sand face of the injection well, resulting in a costly workover job. An operator faced with the problem solved it at the well.

A scrubber or settling vessel was fabricated from a 20-foot section of 10¾-inch casing welded closed at each end with an orange-peel weld. The casing was placed directly on the ground. Input water from the injection pumps entered the scrubber through two-inch pipe and gate valve at one end of the unit. Water was discharged from the scrubber through a coupling welded to the top about two-thirds the length of the casing from the water inlet line. A drain connection and valve on the bottom of the vessel at the end opposite the inlet permit scale and rust to be blown from vessel periodically.

As the water flowed through the vessel, its velocity decreased, allowing scale or foreign particles to settle to the bottom while the clean water discharged out the top line. Before entering the injection well, the water passed through a small filter unit, a water meter and a check valve.

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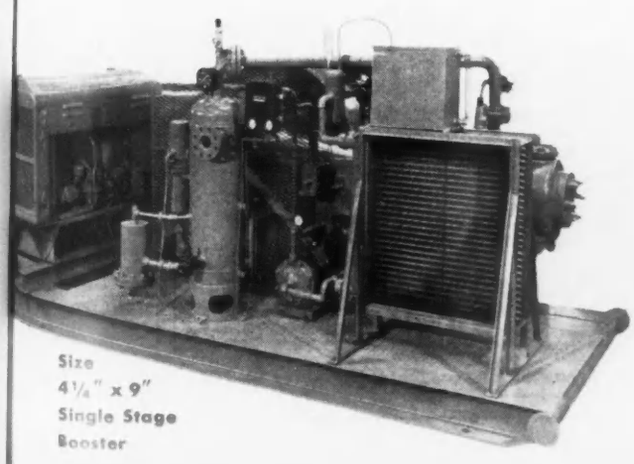
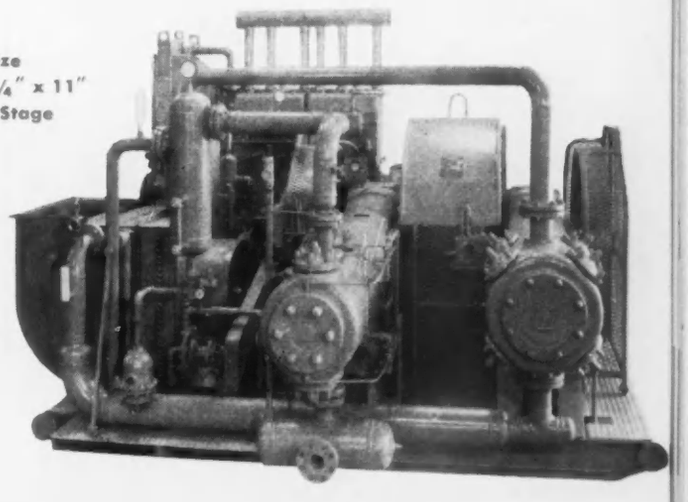


Size
4¼" x 9"
Single Stage
Booster

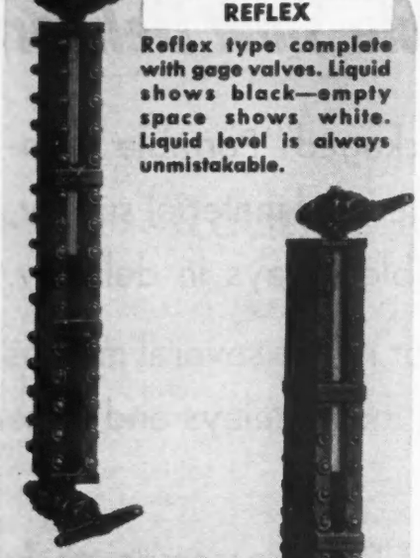
Size
10" x 5¼" x 11"
Two Stage



PENBERTHY
Liquid Level GAGES

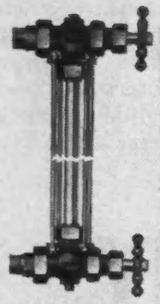
REFLEX

Reflex type complete with gage valves. Liquid shows black—empty space shows white. Liquid level is always unmistakable.



TRANSPARENT

Transparent type complete with gage valves. Used where through vision is desired under high pressures and/or temperatures.

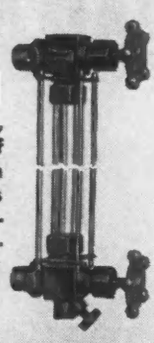


DROP FORGED STEEL

Tubular glass type, Chrome-Moly temperature resisting steel body, stainless steel trim, regrinding removable seats.

ALL IRON

Tubular glass type, extra heavy body of special high strength alloy iron, shanks alloy steel, trim stainless steel, valves self-cleaning.



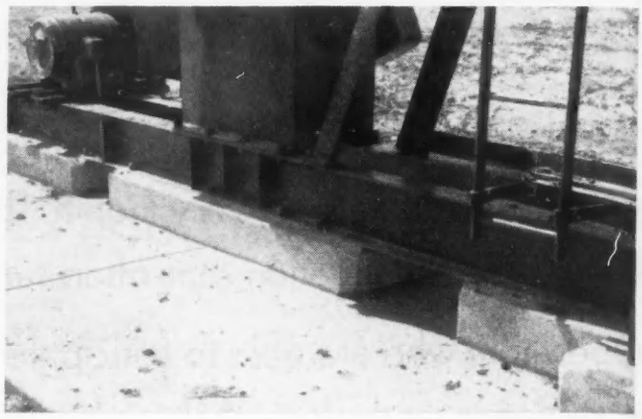
There is a Penberthy Gage of superior quality for every liquid level gage requirement. Gages are fabricated to customer's specifications from special alloys to meet unusual corrosive and temperature conditions. All Penberthy Gages conform with API-ASME requirements.

3277-B

PENBERTHY PRODUCTS

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant — Windsor, Ontario

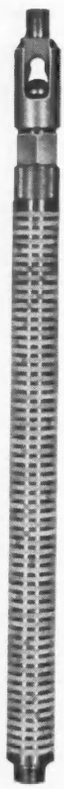
HOW TO—Pour Pump Unit Footing



A good housekeeping practice followed by a company operating in the West Texas area consists of designing the pumping unit foundation so that sweeping and cleanup work around the unit can be done more easily and efficiently.

In this instance the base, or mat, is an elevated one similar in some respects to other types but differing in that it is divided into three sections separated by spaces approximately two feet wide. The base is in no way less sturdy than the continuous type footing, and it has the advantage of providing a means by which the pumper or cleanup men can sweep or hose trash and debris from beneath the I-beam bases of the unit.

Previously, it was necessary, when paper, weeds and other wind-borne trash accumulated between the base members, for a man to laboriously pick them out by hand. With the open base, there is a better chance of such trash blowing on through the openings, simplifying cleanup work.



For Rod or Tubing Pumps

Pulling too often - - - - - - ?
Costly pump repairs - - - ?
Lost production - - - - - ?

INSTALL

√ Martin Plungers
√ Martin Cages

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J. L. Davis, Tel. MOhawk 4891, Houston

JOHN N. MARTIN
MANUFACTURER
9 W. Brady St., Tulsa, Okla. Tel. 4-9415

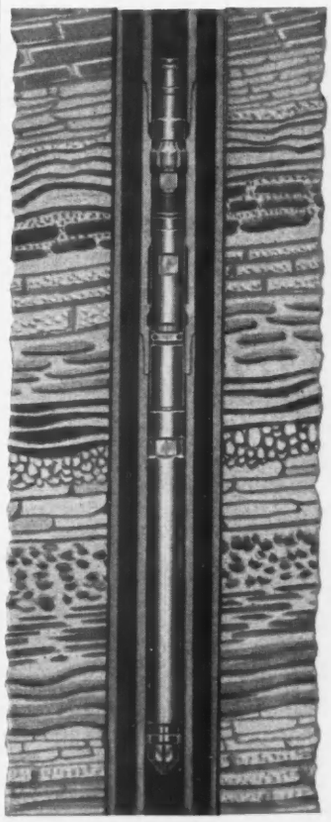
HOW TO—
Maintain Sufficient Ice Water for Crew

At production camps everywhere, more ice water is required during the summer months than can be practically supplied by the ordinary water cooler which requires ice. Here is an idea to modify and improve the utility of the conventional water cooler.

This ten-gallon insulated, galvanized sheet metal cooler is lined from top to bottom with ½-inch copper tubing coiled as tightly as possible. The copper tubing enters the water can at the bottom through a water-tight seal, and at the top is brazed to the base of the regular spigot valve which is normally supplied with such water cans. Instead of using the spigot at

the bottom, it is placed at the top of the cooler can in a hole drilled for this purpose. The hole through which the spigot normally is mounted in the can, is used to connect the inlet water line attached to the copper tubing coil.

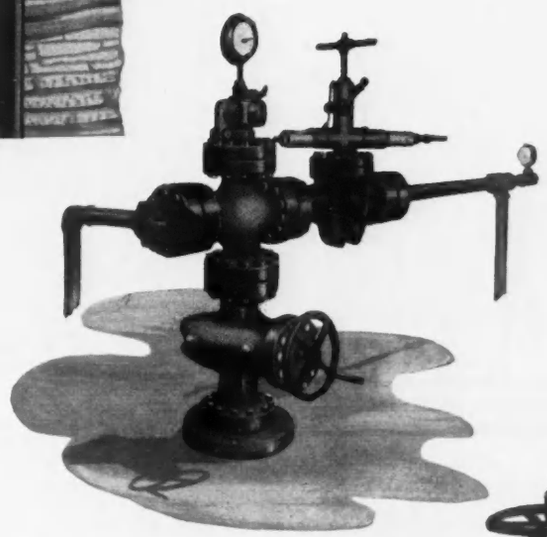
A heavy load of crushed ice is placed inside the coils and covered with water to serve as a cooling unit. The water inlet line is connected to the drinking water system which is under about 50 pounds pressure. The ice water inside serves merely to cool the water passing through the coils. In this manner, ample ice water is furnished without exhausting the supply of ice inside the cooler. If the lid on the cooler is kept in place, the load of ice put in the cooler in the morning will last all day without refilling or adding ice.

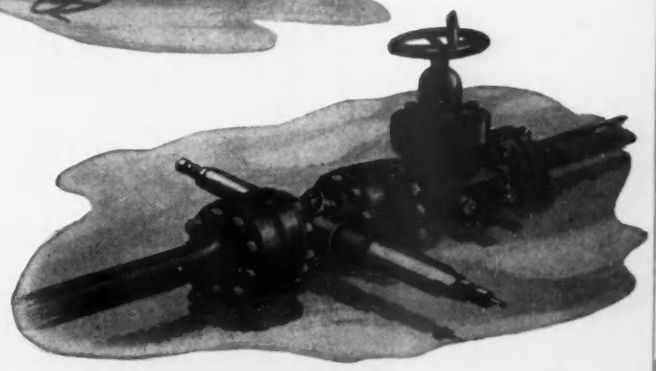


gas
oil
gas-oil

There's an automatic Otis Safety Valve for every kind of producing well—

surface - sub-surface - high-pressure - low-pressure - single-completion - dual-completion . . . ask your Otis field office for complete details and illustrated technical literature.





PRESSURE CONTROL - OTIS - SERVICE - EQUIPMENT

OTIS PRESSURE CONTROL, Inc.

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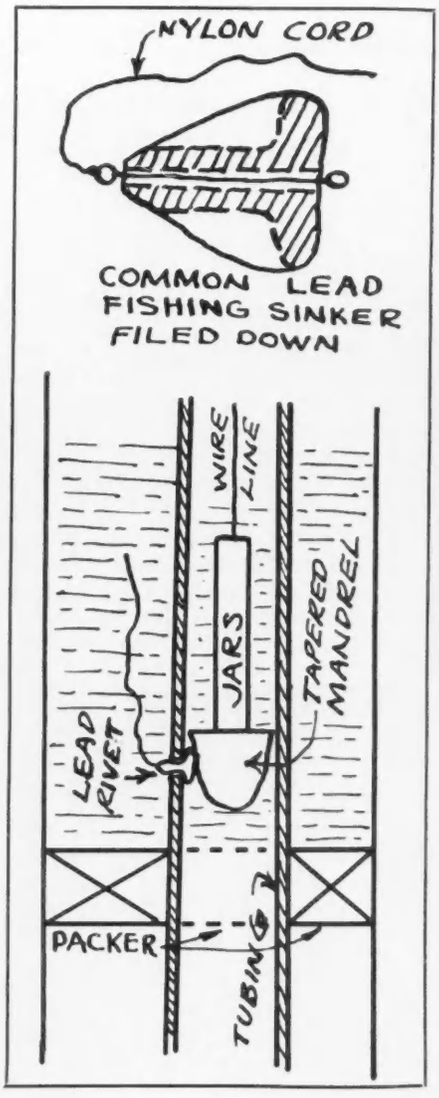
HOW TO—

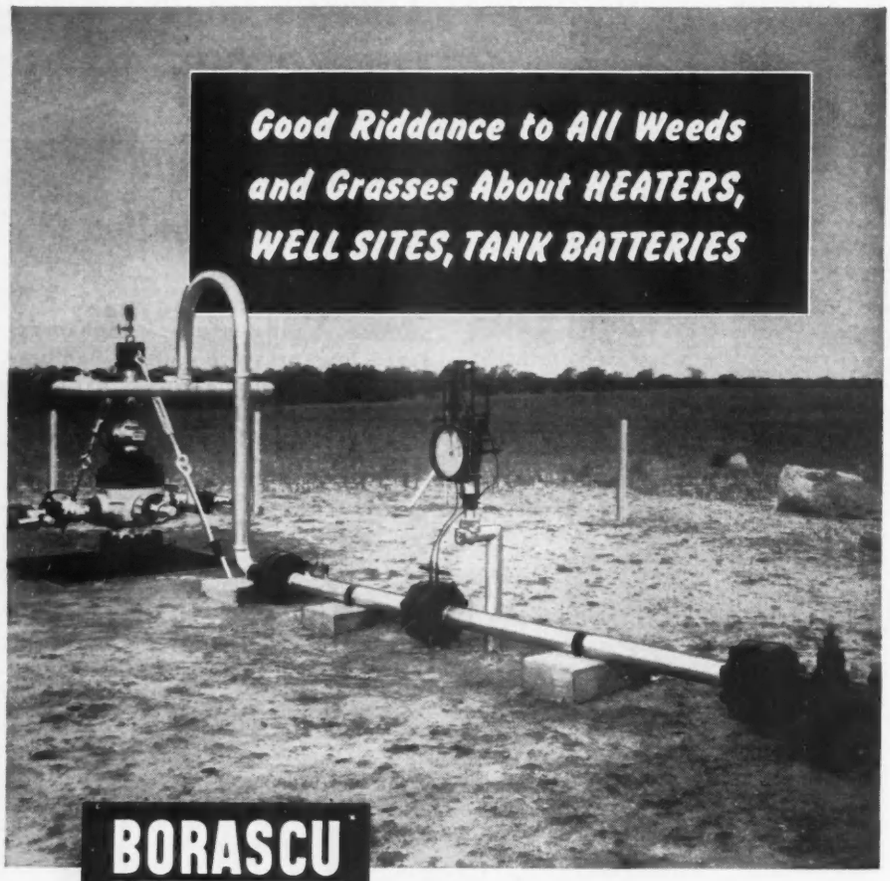
Rivet Single Hole In Tubing String

The hole perforated in tubing for circulation during squeeze cementing or acidizing work can be riveted closed without removing the entire string. When squeezing or acidizing below the packer in completed wells, it is necessary to perforate a hole in the tubing just above the packer to establish circulation through the tubing and up the casing annulus to remove surplus cement or acid. After the job is completed, the hole may be closed by spreading a soft lead rivet in the opening.

The drawing shows the principle of this operation which uses a common two-ounce lead fishing sinker that may be bought for a few pennies. The sinker is filed down in the shape of a rivet. About three feet of nylon cord is attached to the swivel end on the sinker which is then dropped in the tubing and pumped down. Being light and flexible, the long nylon cord usually finds the perforated hole and enters it, thereby guiding the lead rivet into the hole.



Increase of pressure on the mud pumps informs the operator that the rivet has entered the hole. The pumps are shut down, the tubing head is broken out, and a tapered mandrel and wire line jars are run in the hole. The mandrel stops when it encounters the rivet head. Manipulation of the jars drives the lead rivet in the hole. The mandrel is not allowed to pass the rivet completely, since it may pull the rivet out when it is withdrawn. When the mandrel has been removed from the tubing, a pressure test will show how effective the shut-off has been.



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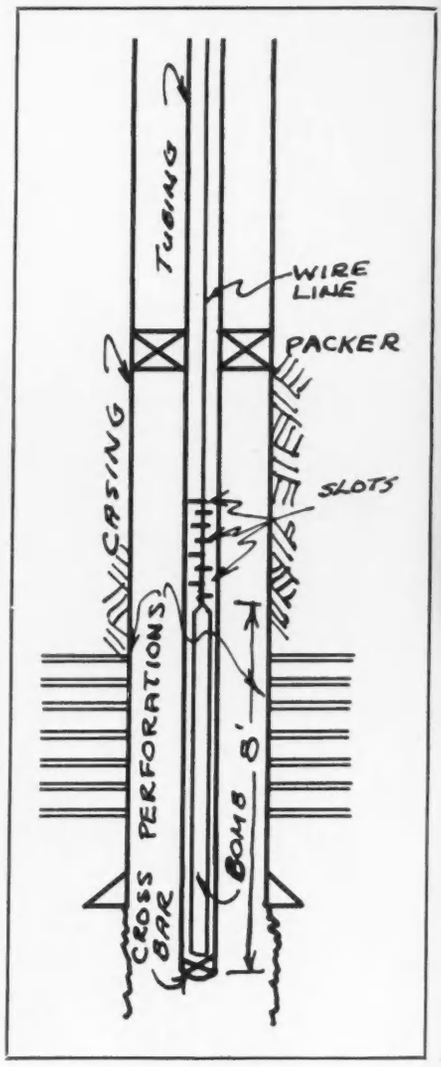
HOW TO—

Set Instrument In Flowing Well

In the beginning and throughout the life of a gas-condensate field it is necessary to take periodic temperature and pressure measurements under flowing conditions. Unless tubing has been set especially to take care of this problem, it is often difficult, if not impossible, to obtain accurate measurements.

Foreseeing such a problem, an operator devised a simple tubing setting in flowing wells that permits running temperature and pressure instrument bombs into the well and taking readings during flow conditions. Tubing was set with a packer, and the casing was cemented through the productive sands and perforated.

The bottom of the tubing was blanked off with a bull plug containing two cross bars welded inside to prevent the instrument from wedging inside the plug. A small hole was bored in the plug to permit continual cleaning of the tubing below the slotted section.



The simple means of solving the measurement problem was to permit the flow of gas and condensate to pass into the tubing above the instrument bomb located in the bottom of the tubing. The slotted joint was placed below the packer so that the slots were at least eight feet above the bottom. Area of the slots was approximately nine times the area of the perforations to minimize friction losses. The eight-foot section below the slots was sufficient to house the instrument bomb when lowered in on a wire line. The line was packed off at the surface and the well opened up. In this manner, the well was permitted to flow for at least 24 hours without any interference whatsoever, while a continuous measurement of either temperature or pressure was made.

MAKE WAR ON WASTE —with a JENSEN

It is good business and sound patriotism to look around for ways and means to cut expenses and eliminate waste. And tax-wise it's a must!

We have looked through the eyes of producers for more than 30 years. We know that any well—this includes YOUR wells—can be more profitable, more efficient and more dependable when equipped with a JENSEN Pumping Unit.

Investigate! Find out why a JENSEN Unit can be your deadliest weapon against waste. See your JENSEN dealer or write us at Coffeyville.

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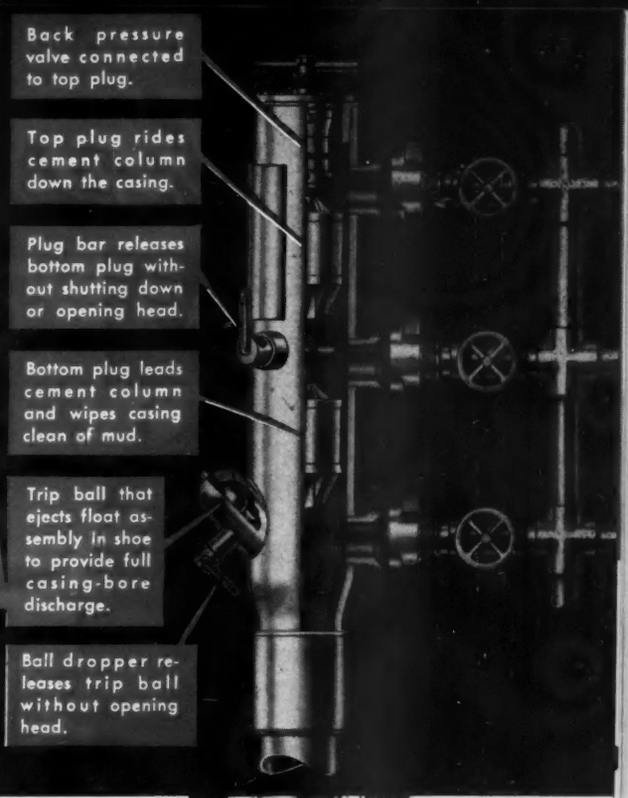
EXPORT OFFICE: 50 CHURCH ST., NEW YORK CITY

From HEAD to SHOE


Back pressure valve connected to top plug.
Top plug rides cement column down the casing.
Plug bar releases bottom plug without shutting down or opening head.
Bottom plug leads cement column and wipes casing clean of mud.
Trip ball that ejects float assembly in shoe to provide full casing-bore discharge.
Ball dropper releases trip ball without opening head.

RECTOR FULBORE CEMENTING METHOD

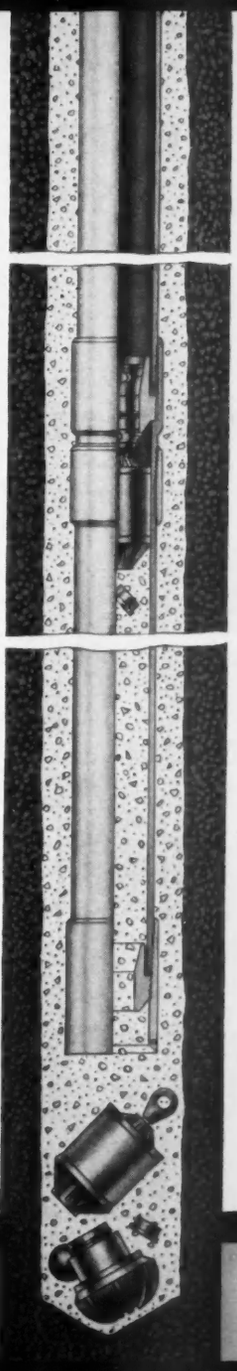
prevents contamination of cement

Every operator knows that voids caused by air pockets in the cementing string or soft spots due to contamination are the perfect set-up for future trouble. Prevention of these weaknesses is the basis of "Fulbore" cementing superiority . . . the assurance of a master cementing job, everytime.

The "Fulbore" multiple inlet head provides a closed circuit from beginning to end of cementing operations. The two plugs, made up in the head before it is connected to the casing string, are released mechanically without downtime. the plugs completely and effectively segregate the cement from the time it enters the head until discharged at the shoe. There is no possibility of contamination or the formation of air pockets.

Extreme simplicity is another advantage of "Fulbore" cementing. There are no discs to break . . . no small orifices through which the cement must be pumped. Traveling ahead of the cement, the bottom plug is pumped out of the casing through the float shoe from which the float assembly has been ejected after cementing string has been floated into position. This provides full casing discharge capacity . . . reduces the load on the pumps . . . permits greater volume to be circulated with same pump discharge pressure . . . results in higher velocity in space between casing and bottom of hole.

Every phase of "Fulbore" cementing is planned to make every job a master cementing job. Ask your Rector Representative or authorized supply store for full information about "Fulbore" Cementing and equipment.



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RECTORHEAD RECTOR FULBORE CEMENTING METHOD RECTORSEAL

ALTEN *has all 3*

LONGEST STROKES

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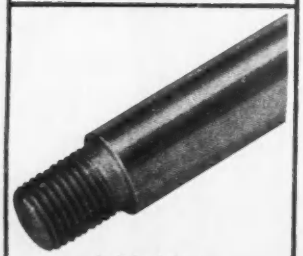
Every Alten Pumping Unit will positively perform to its full rated capacity.

Plus
HARDEST GEAR SURFACES

ALTEN

THE WORLDS BEST PETROLEUM EQUIPMENT

Polished Rod Clamp



Polished Rod

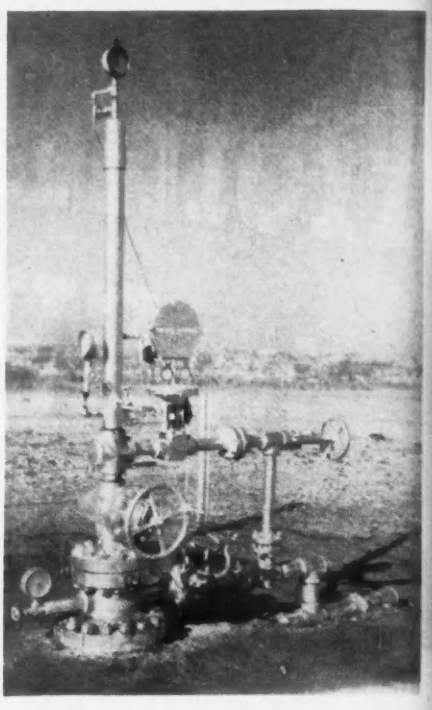
Whether your next equipment purchase is a giant pumping unit or a small polished rod clamp, ask for Alten at your supply store.

You'll get more for your money right from the start because Alten equipment is sensibly priced. You get more for your money through the years because Alten equipment has added engineering advantages to assure top performance and long life.

Stubby Tubing Head

Stop Cock

ALTENS FOUNDRY & MACHINE WORKS INC.
LANCASTER, OHIO



HOW TO—

Connect Stop Cock Controller to Well

Where it is necessary to stop-cock wells to obtain production without wasting formation gas energy, the time cycle controller is usually hooked to the casing for the gas supply to the motor valve. However, if the well contains a packer there is no pressure on the casing and it is necessary to take the gas off of the tubing head.

A chamber on the top of the tubing head will produce dry gas for the controller. It is made from a three-inch by six-foot nipple with one end swaged down to half-inch. Upon it is mounted a pressure gauge and a connection for the controller. A plate is welded across the other end about six inches from the bottom. A quarter-inch needle valve is mounted on a by-pass around the plate. A drain cock with a copper tubing extension is placed just on the upper side of the plate and another valve is connected to the lower side to show the tubing pressure.

In operation, the quarter-inch needle valve is pinched so that gas will pass through, but practically no oil will pass due to the size of the opening. Also, when the tubing pressure is the highest, gas passes through the line and a small amount is bled into the chamber. Sufficient gas to operate the controller is thus obtained.

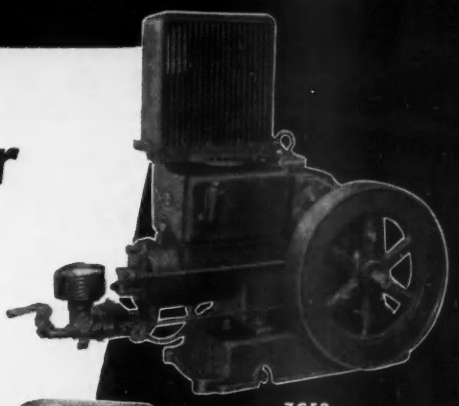
You can Pick the Power to fit the Pump

with the "ZC"

Because the Fairbanks-Morse line of "ZC" Engines is so broad, you can pick the size that will best fit your pumping requirements . . . from 3 to 30 hp.

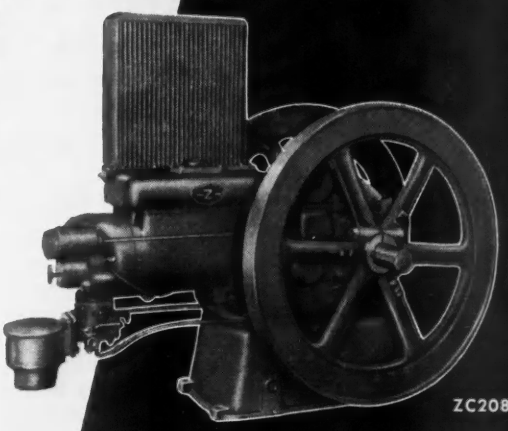
Fairbanks-Morse "ZC" Engines are high displacement, slow-speed, heavy-duty models . . . the ideal type for oil field pumping service. They are economical to operate and maintain . . . simply designed to eliminate need for complicated parts and delicate adjustments. And, *all* have the famous extra heavy, double flywheels that assure smooth, efficient performance . . . with the drive on either side of the engine.

For all the facts, see your local supply store or write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

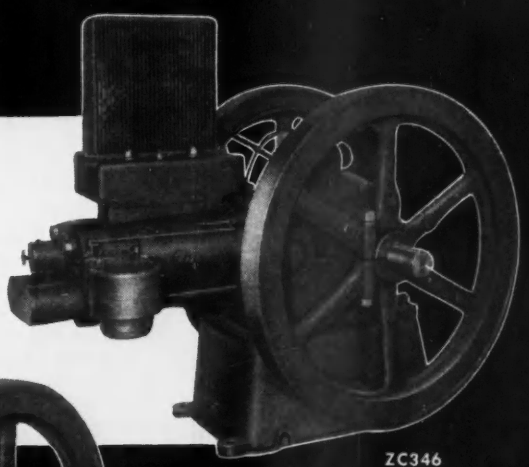


ZC52

ZC118



ZC208



ZC346

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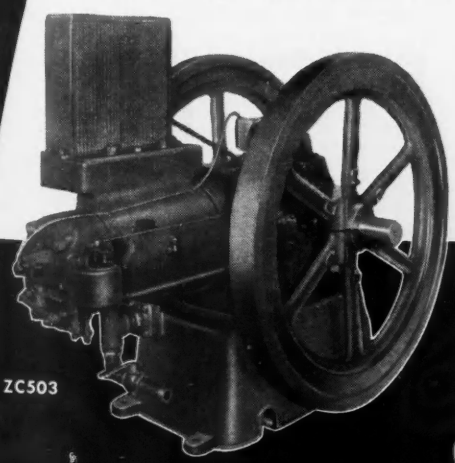
a name worth remembering

OIL FIELD EQUIPMENT • PUMPS • SCALES • ELECTRIC MOTORS • GENERATORS • LIGHT PLANTS • DIESEL, DUAL FUEL AND GASOLINE ENGINES • MAGNETOS • DIESEL LOCOMOTIVES



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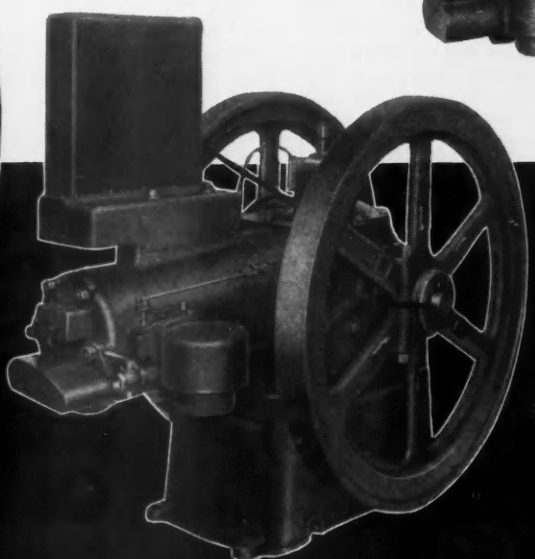


ZC739

HOW TO—

Add Warning Signal To Cattle Guard

A small, inexpensive reflector device, designed to indicate to the driver of a vehicle the presence and width of a cattle guard he is approaching, is one of the practical safety precautions adopted by a major company operating in the West Texas area.

Each cattle guard on the property is equipped with two of the reflectors, one at each side. The circular reflectors are red and, upon catching the beam of an auto headlight, reflect brilliant warning signals.

They are mounted on short lengths of sucker rod material which is welded to the center of the several pipe sections forming the guard. The reflectors are so positioned as to be out of the way of possible damage by wheels

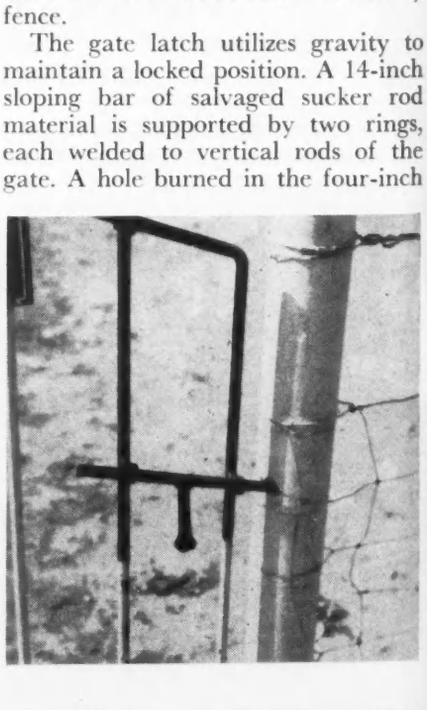
of the vehicle. The light reflector will indicate to the driver where the cattle guard end braces are located so that he can allow ample room when driving over the guard. These reflectors have prevented trucks from running into the very edge of the guard at night where the grass may have obscured the upright braces.

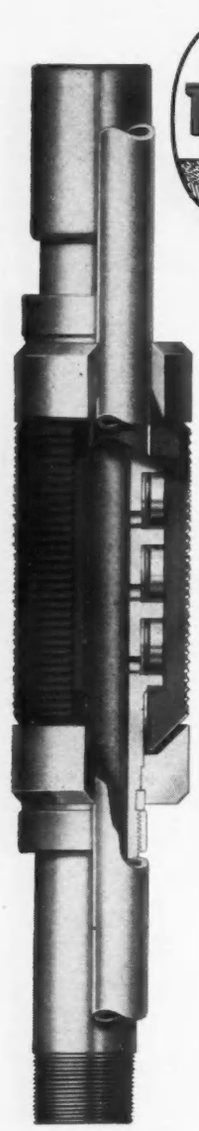
HOW TO—

Make Heavy-Duty, Self-Closing Latch

This simple, heavy-duty gate latch relieves one of the production foreman's headaches: keeping livestock out of the confines of the lease battery fence.

The gate latch utilizes gravity to maintain a locked position. A 14-inch sloping bar of salvaged sucker rod material is supported by two rings, each welded to vertical rods of the gate. A hole burned in the four-inch





PAGE TYPE "C" TUBING ANCHOR

PAGE TENSION TOOLS

NOTE ...TO "FREE PUMP" OPERATORS!

SMOOTH OUT YOUR TUBING TROUBLES with this PAGE TYPE "C" TUBING ANCHOR...

It's *designed* for parallel strings!

The Page Type "C" Tubing Anchor is designed specifically to anchor parallel strings in "Free Pump" installations. Its advantages to operators are many. The Page Type "C" Anchor *assures* a fast tubing run-in without danger of accidentally setting slips, *eliminates* the human element of top-hole manipulation in setting and *saves* valuable time in landing tubing strings. The Page Type "C" *relieves* tubing of fluid and working pressure loads and *increases* the factor of safety in long tubing strings. It enables running longer strings of second grade tubing because the Type "C" *supports* the tubing and holds it in tension, free of "working" loads.

SIMPLE OPERATION

The Page Type "C" Tubing Anchor sets hydraulically on fluid pressure differential. The hydrostatic head of oil in the power string together with the "free pump" surface operating pressure, forces a series of small pistons against v-cut slip segments that grip securely against the casing. Holding power of the slips far exceeds fluid head and operating pressure loads. Release and removal from well requires only drainage of tubing. Tool can be run-in either end up.

SIMPLE CONSTRUCTION

Anchor Body made from a solid billet of steel . . . working force consists of two v-cut slips and six pressure-sealed pistons . . . all parts replaceable and interchangeable.

WRITE now for details or see . . .

Mid-Continent Distributors

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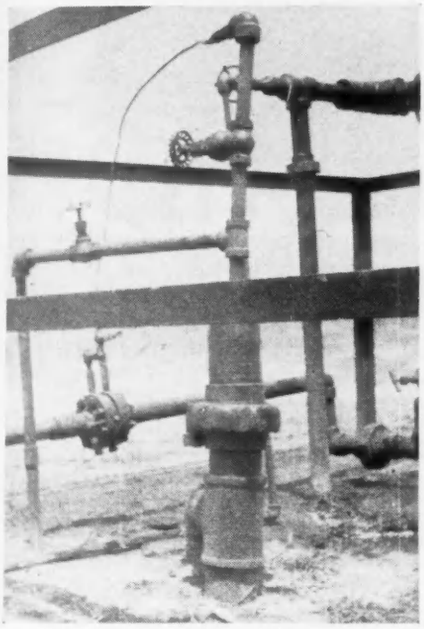
pipe fence post allows the latch bar to pass inside the post easily and form a lock. A short handle welded at right angles to the latch bar makes it easy for the pumper to slide the bar back and forth when opening or closing the gate. Weight of the handle causes the bar to drop down vertically so that cattle will not open the gate accidentally by rubbing against it.

HOW TO—
Reduce Water Well Production Costs



One operator always drills a water well beside the first well on any lease with the intent of pumping it with the same unit which pumps the oil well. However, when it was decided to put a well on gas lift, the engineer installed a jet in the water well and started jetting the well with the gas lift gas. When there was less need for water, he hooked up one ide of the orifice flange to the water well so that the well would be in continual operation, thus preventing it from sanding up.

The water well was cased with three-inch pipe and the jet line was run with one-inch, with a ⅛-inch jet turned up at the bottom. Top of the casing was fitted with a tee to connect the well to the water tank. A one-bolt union supported the tubing head atop a swaged nipple made up in the tee. Connections on the top were made to the orifice flange for small flows and to the main gas-lift line when it was necessary to supply large amounts of gas for drilling purposes.

Eliminate

COSTLY STRIPPING JOBS

MADE NECESSARY BECAUSE OF PARAFFIN ACCUMULATIONS

CRALL Spiral Paraffin Scrapers are the Answer

CRALL Spiral Paraffin Scrapers have been installed in wells that required paraffin removal every ten days. After many months of continuous operation, after scrapers were installed, the wells still maintained normal production. This is a record that can't be ignored.

PASS SCRAPERS EVERY STROKE UP AND DOWN

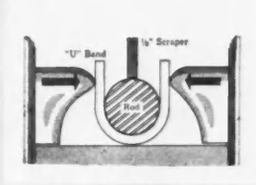
Check these features and prove for yourself that CRALL Spiral Scrapers cost you nothing in the long run. Many times they have paid for themselves in less than two months.

1 Scrapers alternate — one right, one left — eliminating tendency of the rod to unscrew.

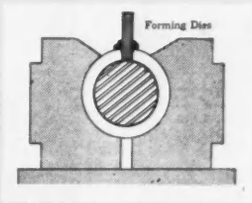
2 Scrapers are attached at our own plants under our personal supervision, and stocked at supply stores.

3 No maintenance costs. Practical, economical and adaptable to ANY pumping well.

4 Made of thick, mild steel. Sizes to fit 2" and 2½" tubing regardless of size sucker rod.



Cross section showing "U" band being die-formed around rod to the scraper blade.



Cross section showing band held under pressure around rod while ends of band are shrink-grip attached to scraper blade.

The original installation is the only cost. Order your CRALL Spiral Scrapered rods from your supply store or wire, write or phone . . .

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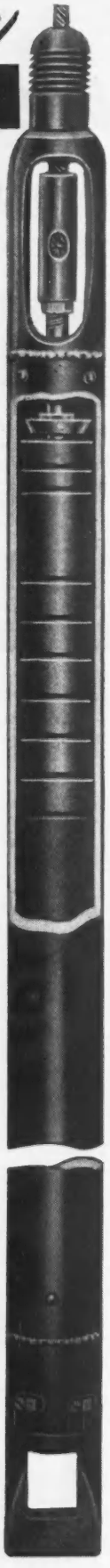
Miller SAND PUMPS



In every major producing area where sand or sediment is a problem, you'll find Miller Sand Pumps and Bailers are standard . . . the leaders in clean-out equipment. For 26 years Miller has held this leadership, with continuous improvements and faithful service.

The Miller Sand Pump is made in regular and heavy duty types in sizes listed below. Lug type, chisel, sand and bailer bottoms are easily interchanged.

SAND PUMP and BAILER SIZES:

Outside Diameters

2½"
3"
3½"
4¼"
5"
5½"
7"

Lengths

20 feet
25 feet
30 feet

Special Sizes and Lengths Made to Order!

Write for new descriptive price list on Miller Sand Pumps and Bailers. See Composite Catalogue Page 3305 for details.

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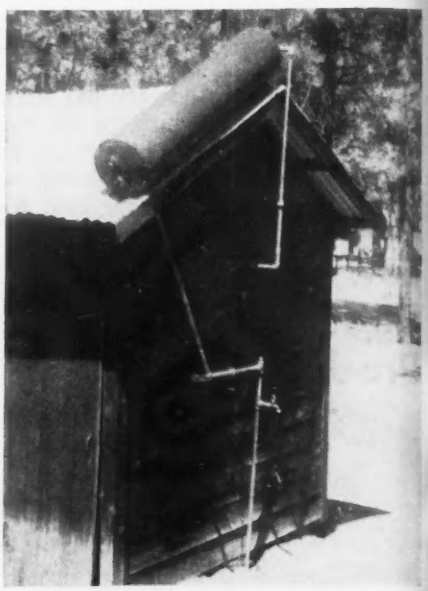
HOW TO—

Provide Warm Water For Crew Washroom

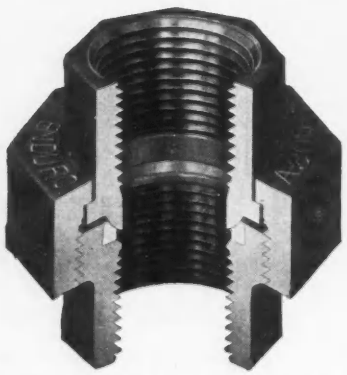


Almost any oil field scrap pile will provide the materials needed to construct an efficient solar water heating system which will produce warm to hot water on warm, sunny afternoons. The volume tank can be made from a nipple of 10¾-inch casing about eight feet long, and it can be placed on the southern segment of a hip roof housing the camp's washroom. In this manner, the tank will be exposed to both the morning and afternoon sun.

The solar heating system illustrated provides shower water for the evening roustabout crews working in a California field. The tank is mounted on the edge of this wash shed and connected with the cold water inlet line at the lower end. The discharge line is welded to the end of the tank at the peak of the roof, and piped down into the side of the wash room.

Such an installation could be provided at locations where hot water facilities are not available. The design could even be improved by laying a series of pipes on the sheet metal roof in the form of coils so that a maximum volume of water is exposed to the sun, the coils acting as a heat exchanger. In winter during freezing weather, the coils could be drained, and the unit bypassed.

Jefferson Malleable Unions



JEFFERSON'S *ENDURO* unions available in brass-to-iron, and iron-to-iron seats. Certified Air Furnace iron used in the ENDURO line is A.S.T.M.-4733-Grade 35018 malleable, having a 53000# Min. Ten.

ENDURO—300# S.W.P.—600# C.W.P.

Certified Air Furnace iron produces a constant, uniform, finer grain structure union. This provides a much better iron with which to provide a positive dependable seating surface.

Unions manufactured from this malleable iron afford 30% more strength; 50% more impact value; 75% more elongation. Sizes ¼" thru 3".

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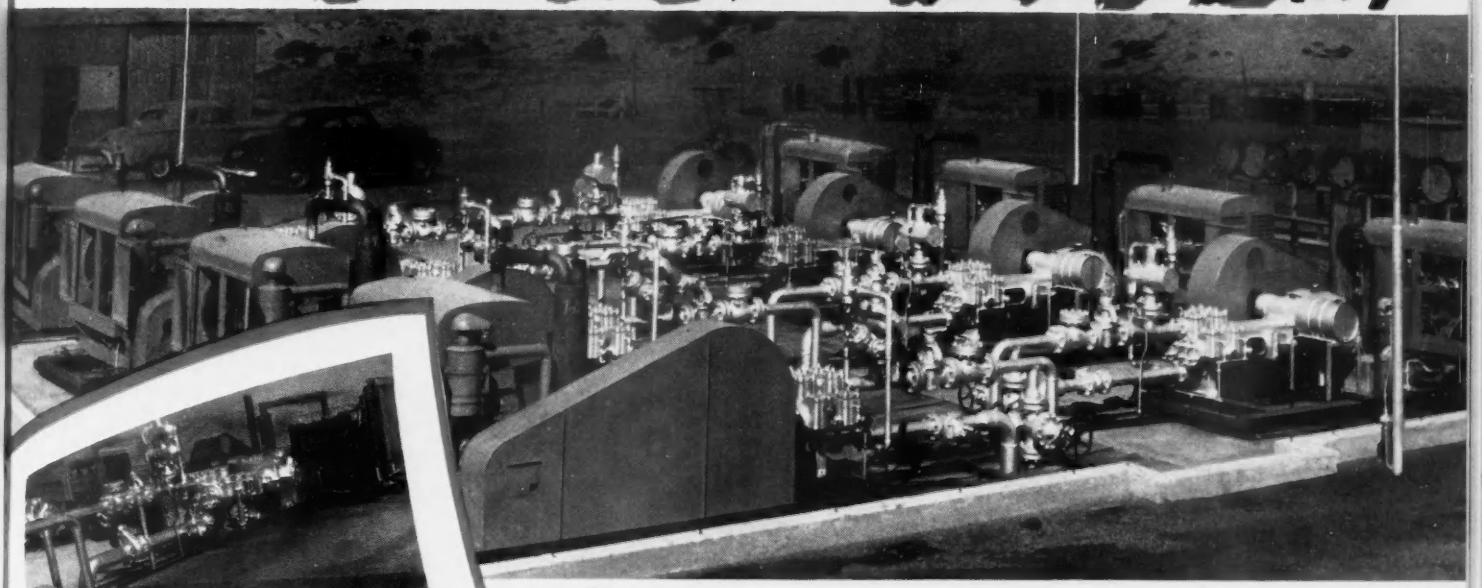
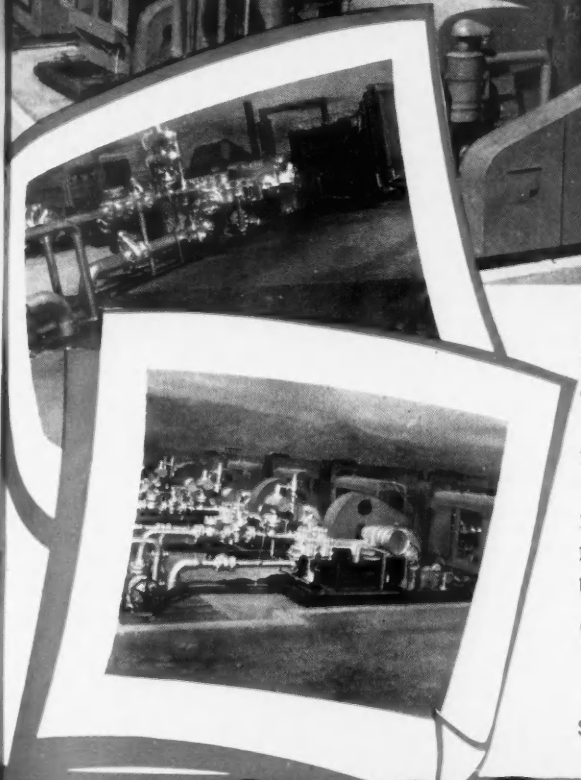
Pipe Line Section

DONALD M. TAYLOR, SECTION EDITOR

WORLD OIL

We help to feed RICHFIELD'S $7,000,000 "Baby"





BIG pipe lines like Richfield's, once laid, become fixed and permanent installations. It is the feeder lines that provide flexibility and expansibility, and that's where Gaso Pumps come into the picture.

They help to feed main lines by powering the auxiliary lines that reach out into tank farms, field storage and other source-points of oil.

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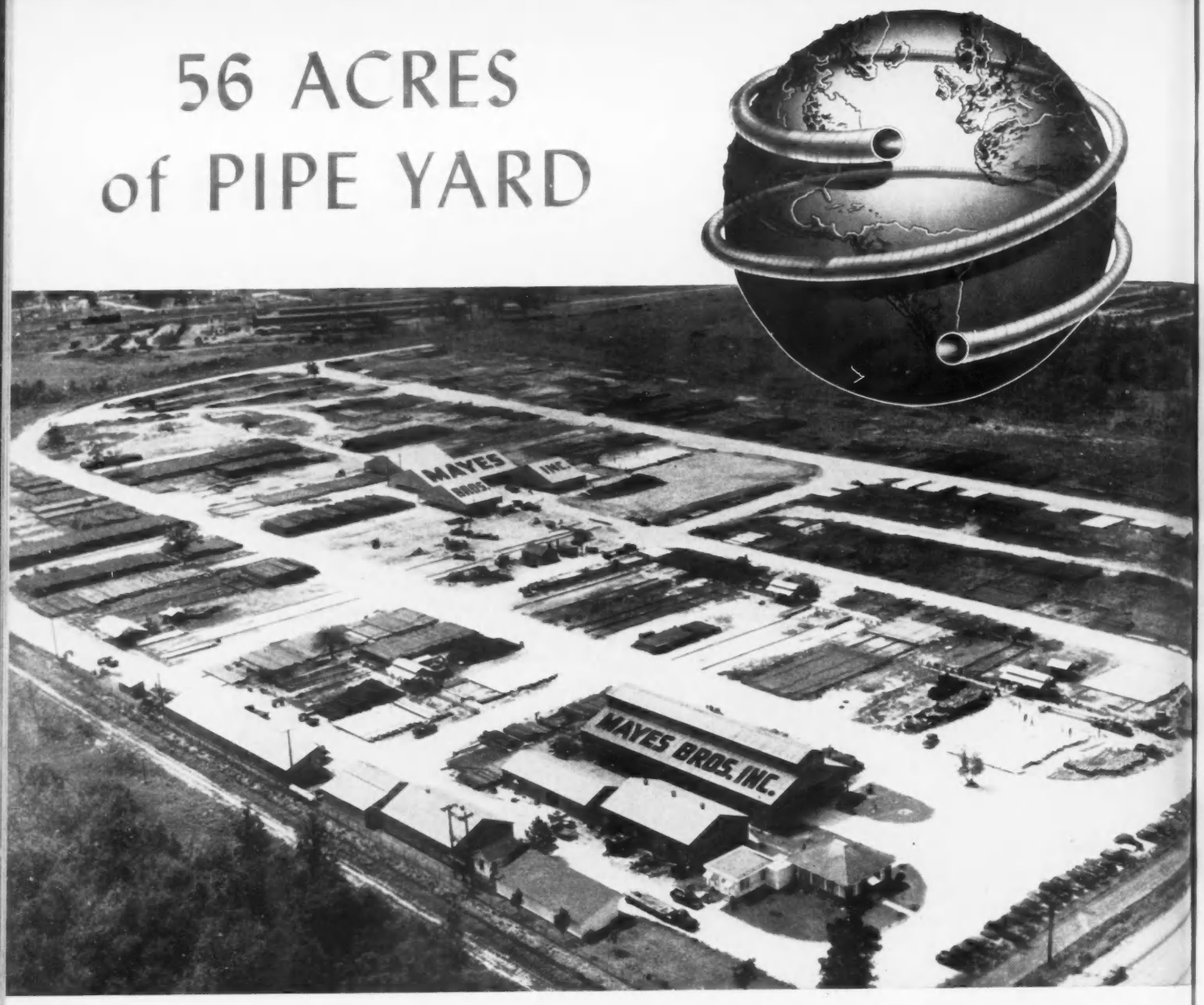
GASO PUMPS

for every oil industry need

56 ACRES of PIPE YARD



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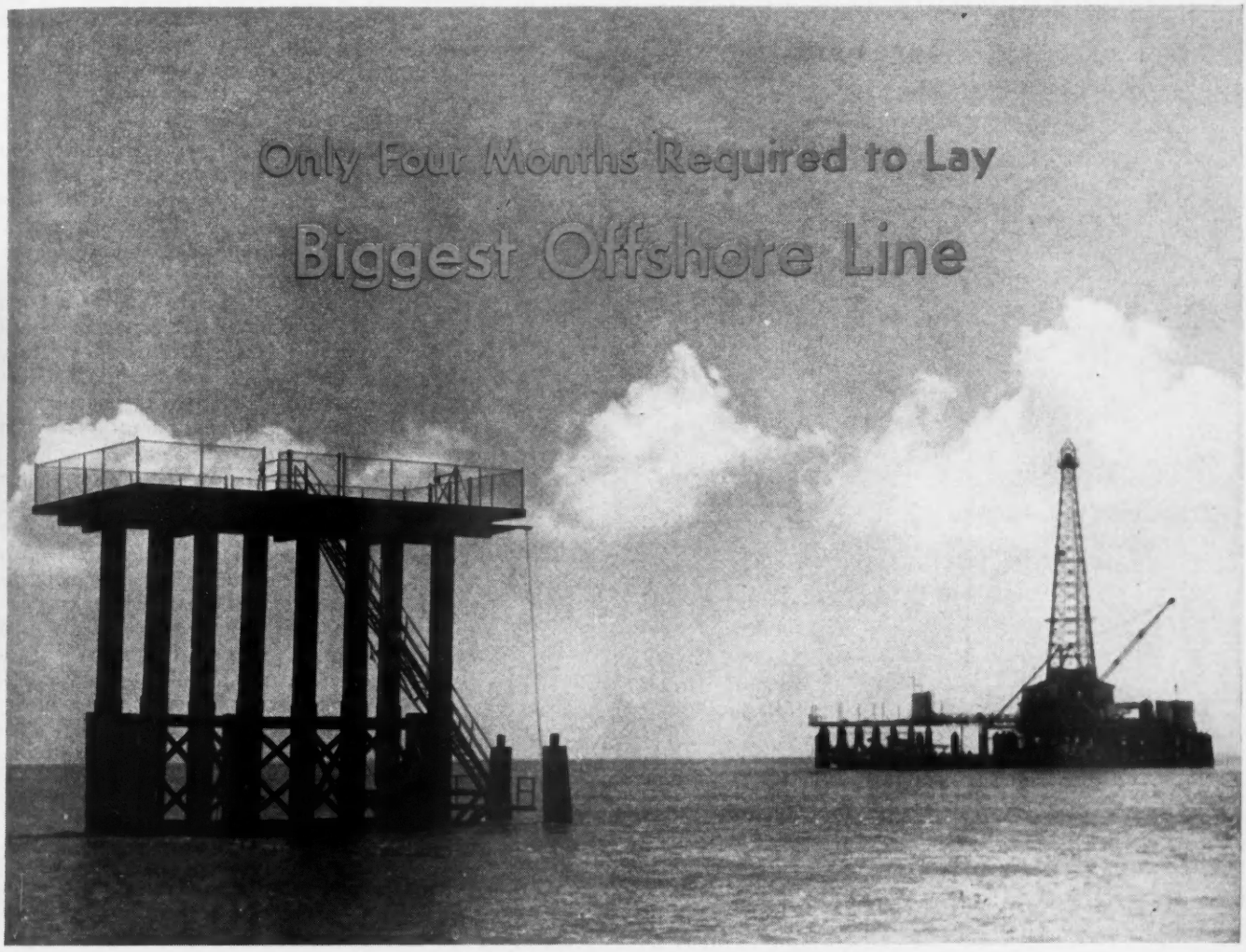
Only Four Months Required to Lay Biggest Offshore Line



Junction point of 20½-inch and 14-inch pipe lines is United Gas Company's platform located 1000 feet from The Pure Oil Company's Block 32 drilling platform.

By DONALD M. TAYLOR
World Oil Staff

SO HIGHLY ORGANIZED and well planned was engineering and construction on United Gas' big-inch offshore pipe line that the job was completed in fast time with seeming ease. Here are some of the details of construction which were carefully worked out in three years of planning to speed this epochal job.

SPANNING 25½ miles of the open waters of the Gulf of Mexico to tap offshore gas reserves is United Gas Company's 20½- and 14-inch pipe line—an unprecedented feat in pipe line engineering and construction. The line is a key link in United Gas' expansion program designed to increase system capacity 920 million cubic feet per day.

Three years of planning, months of preparation, and highly organized construction forces combined to move the job at a swift pace. Less than four months after laying operations commenced, 15 miles of high pressure 20½-inch line linked the Louisiana shore and United's platform in The Pure Oil Company's Block 32; and a 14-inch line extended on to Magnolia Petroleum Company's Block 51 drilling platform, 10½ miles away.

The 15-mile section of 20½-inch line was constructed by Gulf Southern Contractors, J. Ray McDermott Company, and Associated Pipe Line Contractors. The 14-inch line was constructed by Brown and Root, Inc.

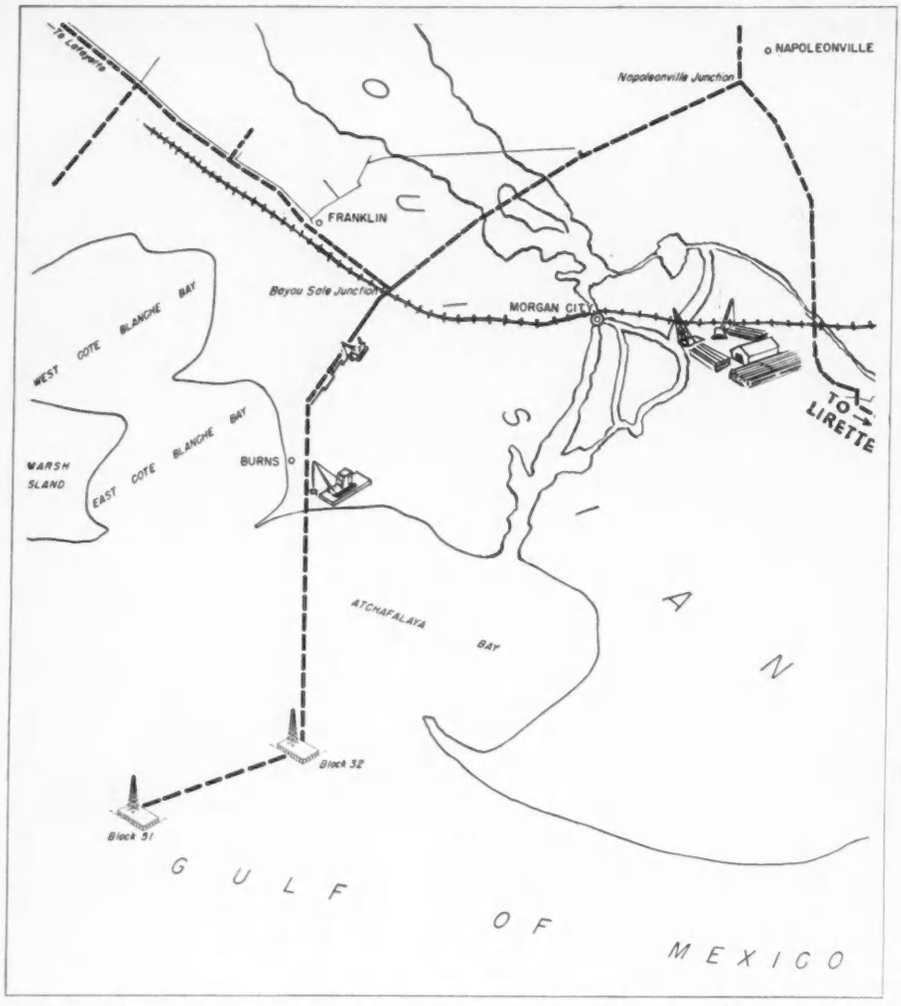
Pipe Yard

Playing a vital role in construction of the 20½-inch line was the pipe yard on Bayou Boeuf. Here, the 20½-inch well pipe—fabricated by wrapping a one-fourth-inch steel sheet around ordinary one-half-inch wall 20-inch pipe—followed an assembly line pattern, starting when 40-foot lengths were unloaded from incoming barges and ending when 200-foot jointed sections—asphalt-base coated and concrete-jacketed—were stowed on outgoing barges for transportation to the offshore ramp.

Entering the yard, the pipe weighed 154.19 pounds per foot. After following a rectangular path through the yard, to receive a five-eighths-inch coating weighing 39 pounds per foot and a steel-wire reinforced cement and sand jacket weighing 70 pounds per foot, the pipe scaled more than 260 pounds per foot. After individual joints were coated, Associated Pipe Line Company welders five-jointed the pipe, using more than 20 passes per weld.

Offshore Ramp

On arriving at the 670-foot-long, barge-supported pipe ramp, the 200-



A 20½-inch line was laid from shore to Block 32, a distance of 15 miles; and a 14-inch line from Block 32 to Block 51, a distance of 10½ miles.

foot sections were mounted on four narrow gauge railway-type trucks which fitted tracks on the inclined ramp. Hoisted aloft and onto the ramp by a derrick barge, the pipe began its seaward journey.

On the ramp work was performed at three stations spaced 200 feet apart. At the first station, 200-foot sections were lined up and joined together, two welders completing approximately half the weld. At the second station the weld was completed and X-rayed. At the third station, located between the ramp's end and where the pipe enters the water, joint moulds of coating were applied over the newly made welds.

Twin 16-foot-long, four-foot diameter pontoon assemblies, spaced 400 feet apart, supported the pipe during its travel through the water. Crews working beneath the water lashed the pipe to pontoons in such a manner that it would be suspended four feet under the surface. Divers from a small barge crane, anchored 1500 feet offshore, inspected and adjusted pontoons to prevent abrasion of the pipe coating.

A pulling barge in constant radio contact with the ramp towed the section of pipe to sea in 200-foot pulls. When 8000- to 10,000-foot sections of the pipe were completed, with bullplugs at either end to keep the inside dry, the pulling barge towed the pipe to its final position in the line. A derrick barge moved along the section, lifting the line enough to facilitate removal of individual pontoons and then carefully positioned the pipe on the Gulf bottom. Marker buoys attached to each end of this section were all that appeared above the surface.

Eight separate sections were fabricated and placed end-to-end in this manner to span the 80,000-foot leg of the system from shore to platform.

Tie-Ins

The tie-ins were completed by using two derrick barges, a work barge, and an equipment barge. The two ends were lifted from the water onto the work barge. Widely spaced derrick support fore and aft the barge permitted the line to assume a horizontal position. The overlapping bullplugged ends were trimmed for fit and the tie-in weld was made. The line was again lowered to the bottom.

Final step in the operation was to "jet" the approximately five miles of line five feet below the bottom of the Gulf to its permanent depth. Huge barge-mounted pumps were tied to jet nozzles on a framework which slowly rolled along the pipe beneath the water. High pressure streams from the nozzles sluiced the sand and soil into twin suction heads which removed cuttings from the area of operations. As the assembly moved along, the pipe settled to its resting place where currents of the Gulf will backfill it.

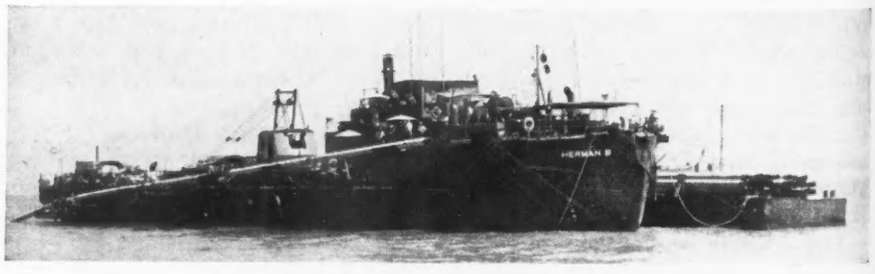
14-Inch Line

Operations on the 14-inch section of the pipe line were delayed when pipe deliveries were late. Actual operations began August 3.

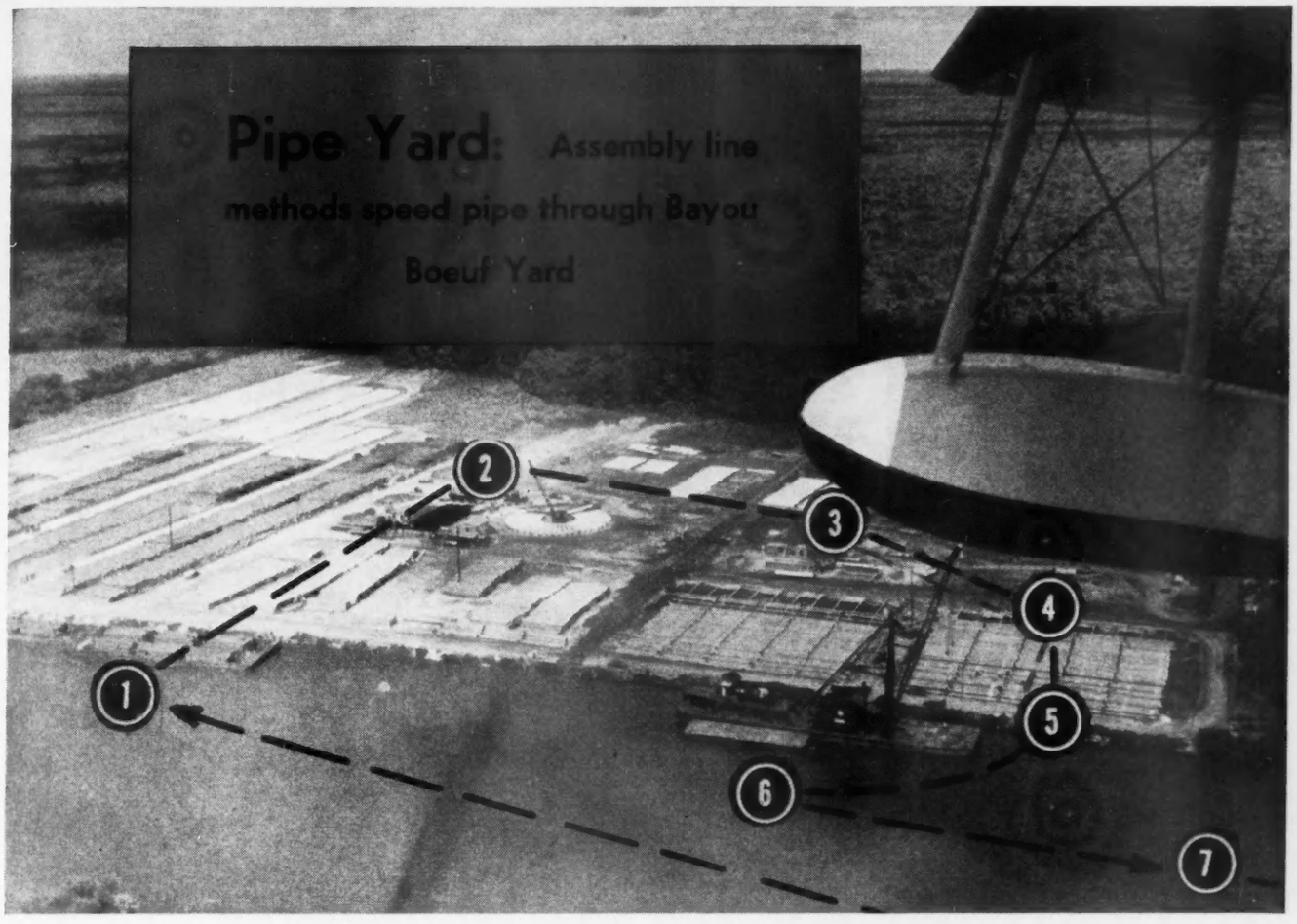
The bare pipe (half-inch wall weighing 72.09 pounds per foot) was covered with a one-half-inch asphalt-base coating and a steel-wire reinforced concrete jacket. Final weight of 139.61 pounds per foot gave the pipe a negative buoyancy of 39 pounds per foot.

Brown and Root laid the line one joint at a time ("stovepiping") using a specially revamped naval barge. Depth of the water along the route varied from 12 to 20 feet permitting free action of marine equipment.

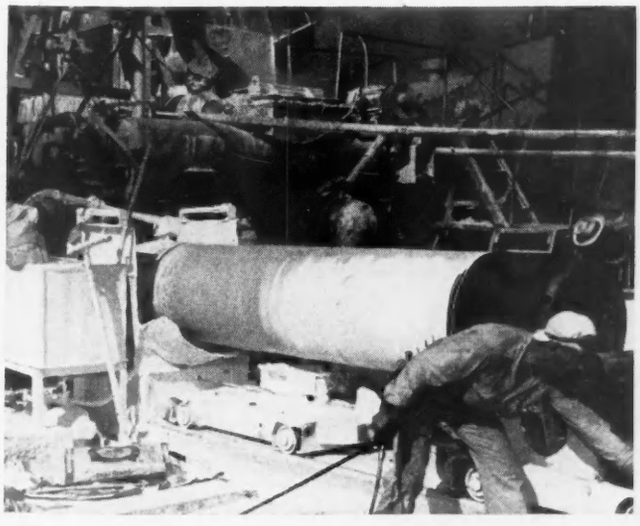
Working around the clock, Brown and Root averaged 2000 feet every 24 hours. When the line was welded out the company used special jetting equipment (patents applied for) to sink the line to its permanent depth.

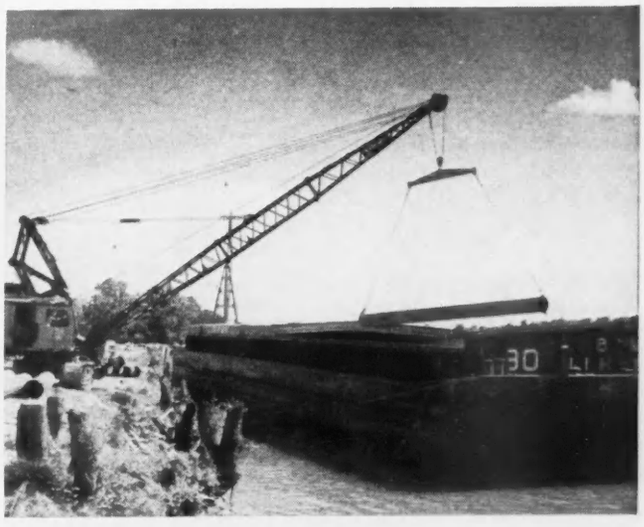


Laying 14-inch pipe line in open Gulf.



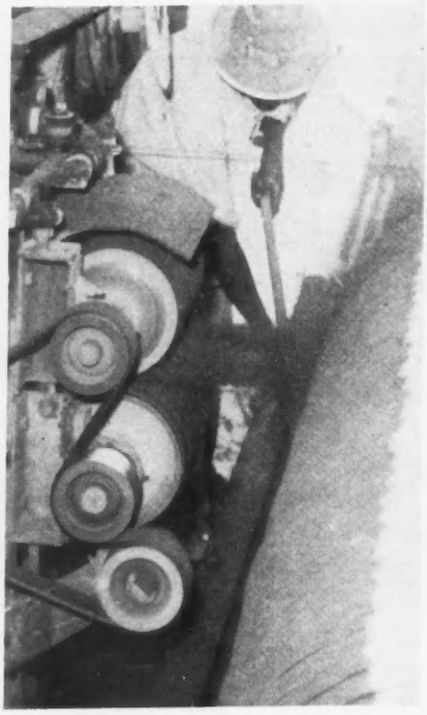
The 40-foot joints of 20½-inch pipe are unloaded onto pipe racks at 1; rolled to H. C. Price's coating plant at 2, where they receive five-eighths-inch coating; moved to Rosson-Richards plant for concrete jacket at 3; thence to 4, where Associated Pipe Line Contractors weld them into 200-foot joints and the welds covered with joint moulds; then rolled to water's edge at 5 where a J. Ray McDermott derrick barge loads them onto barges at 6 for transportation to offshore ramp at 7.

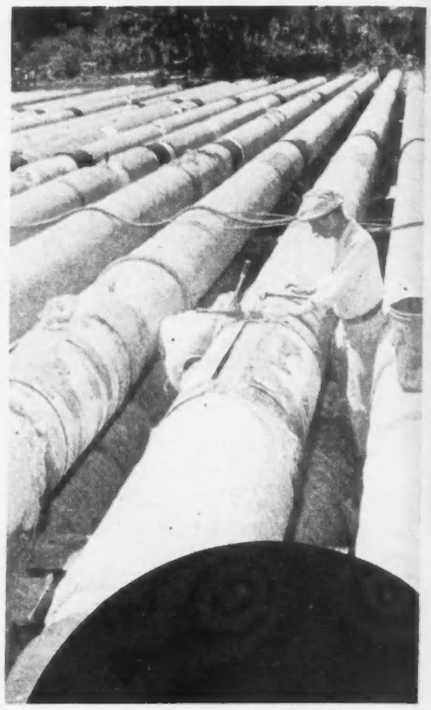




STEP 1 (right). Pipe enters yard. The 20½, three-fouths-inch wall pipe was made by wrapping quarter-inch steel plate around 20½-inch wall pipe.

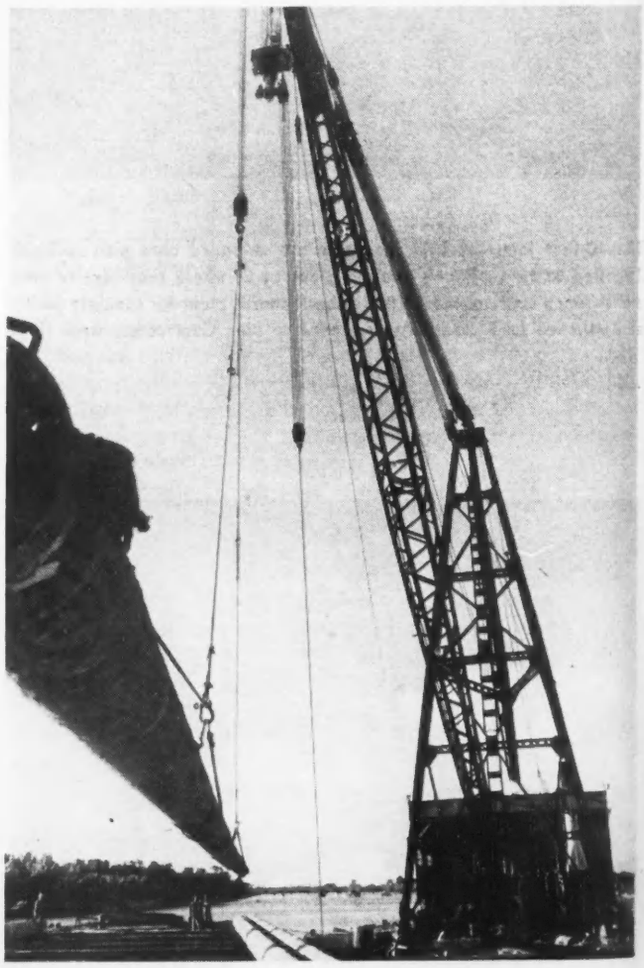
STEP 2 (left). Pipe moved rapidly through coating plant, receiving a coating consisting of 14 percent asphalt, 63 percent sand, 22 percent lime, and 1 percent asbestos. Coating weights 39 pounds per foot, is plastered onto pipe under pressure at temperature of 355° F., then covered with whitewash to protect it from sun's rays after coating has set.



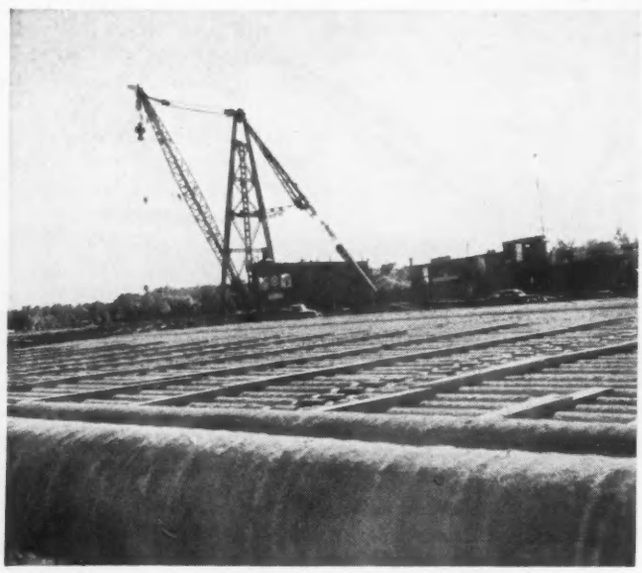


STEP 3 (upper left). Pipe receives steel wire reinforced concrete jacket which adds 71 pounds of weight per foot to the pipe. Addition of barytes was unnecessary due to heavy wall thickness of pipe. UPPER CENTER: Top roller in coating process is a brush which slings cement and sand grout onto pipe from high speed conveyor underneath.

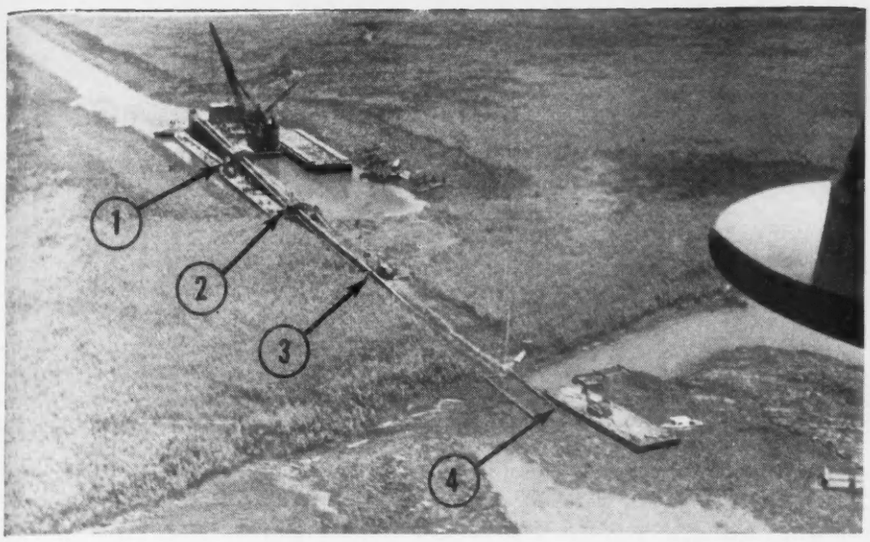
STEP 4 (upper right): After welding is completed, the five-joint lengths of pipe are rolled on racks toward the water's edge. Welds are covered with joint moulds of somastic and breaks in concrete jacket are repaired.



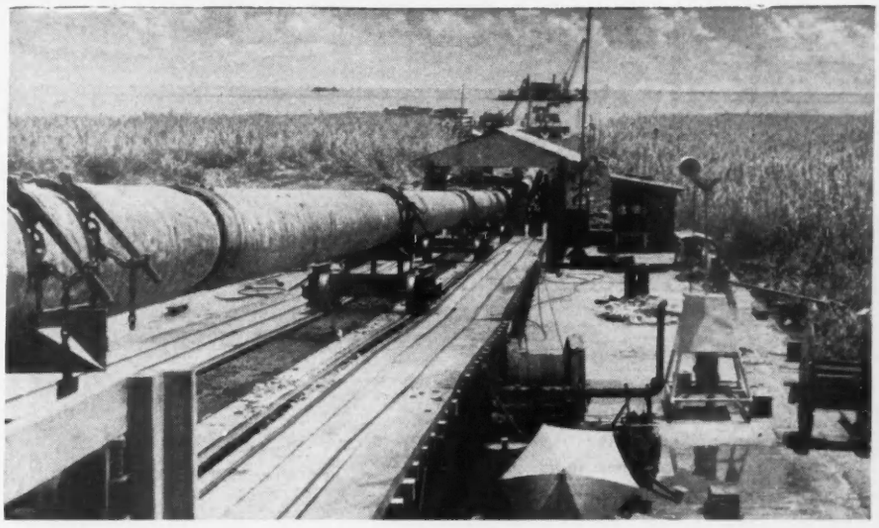
STEP 5 (left): Pipe is rolled to water's edge for outloading.

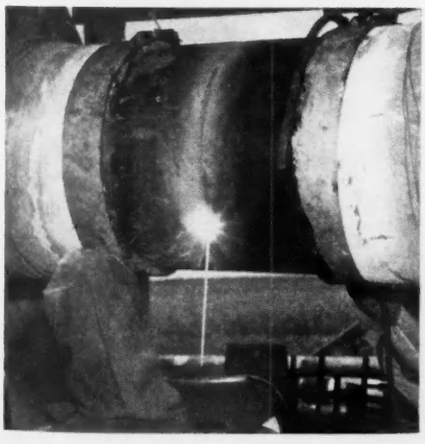


STEP 6 (above): Derrick barge swings 200-foot section of pipe weighing 52,000 pounds onto barge for transportation to offshore ramp.



Offshore Ramp: Work is performed at stations spaced 200 feet apart as pipe goes to sea in 200-foot pulls.





TOP PHOTO: The offshore ramp. The 200-foot sections of 20½-inch pipe are lifted onto the ramp from a barge and half of weld made at 1. Weld is completed and X-rayed at 2 and covered with joint mould at 3. After pipe enters water pontoons are attached at 4 to buoy the line on its seaward journey.

STEP 1 (center left): Derrick barge lifts section of pipe onto the 670-foot long inclined ramp. Note narrow gauge railway trucks chained to pipe. Center right: After line-up and a portion of the welding has been accomplished, the winch barge at sea pulls the pipe ahead 200 feet.

STEP 2 (lower left): About 22 passes usually are required to weld three-quarter inch wall pipe.

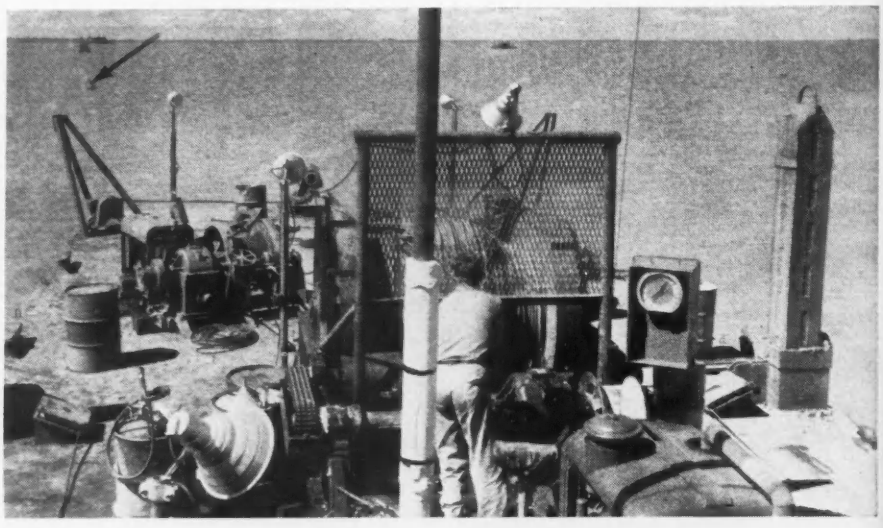
STEP 3 (lower right): Joint mould is applied to cover the new weld.

STEP 4 (left): Tractor on light barge lifts pipe from water so it can be lashed to twin 16-foot long pontoons spaced 400 feet apart. RIGHT: Diver secures and inspects lashings. The 20½-inch pipe is suspended about four feet beneath the surface.

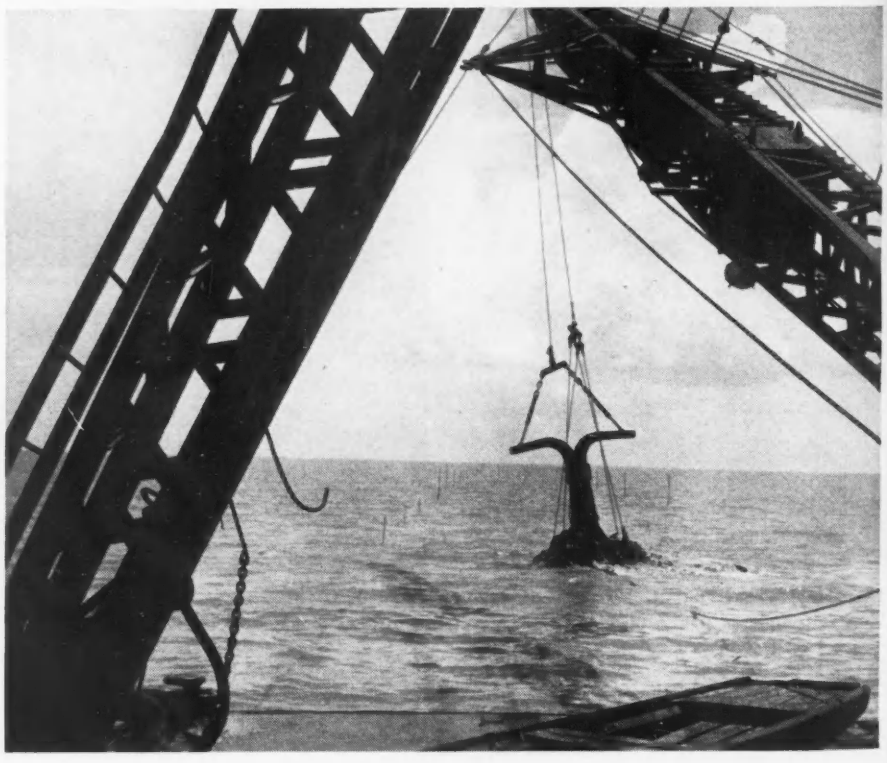
★

Work at Sea:

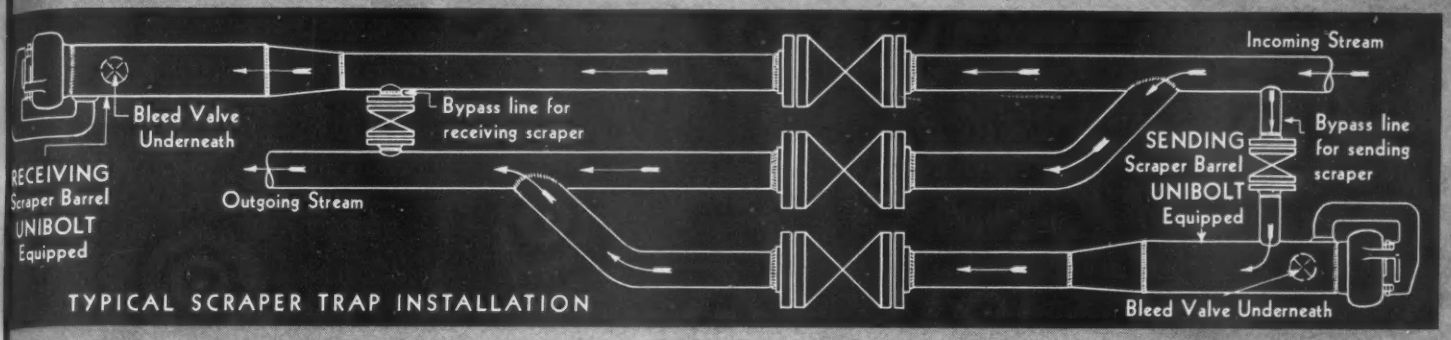
Seagoing pipe-liners work in close coordination with land forces to speed work.



TOWING (top photo): As the 200-foot sections of pipe were welded together on the ramp, this winch barge—in constant radio contact with shore—pulled them seaward. When the string tolled about 10,000 feet the barge, assisted by tugs, towed the section to its final position in the line, moving ahead in short skips and winching the section of the line behind it. Here, the barge is pulling the pontoon-supported section of line (indicated by arrow) and the force of the pull is counteracted by spuds—the square column at extreme right—and anchors. The clock-like instrument at the operator's right is a weight indicator which indicates the force of the pull. This barge is capable of pulling 155,000 pounds.

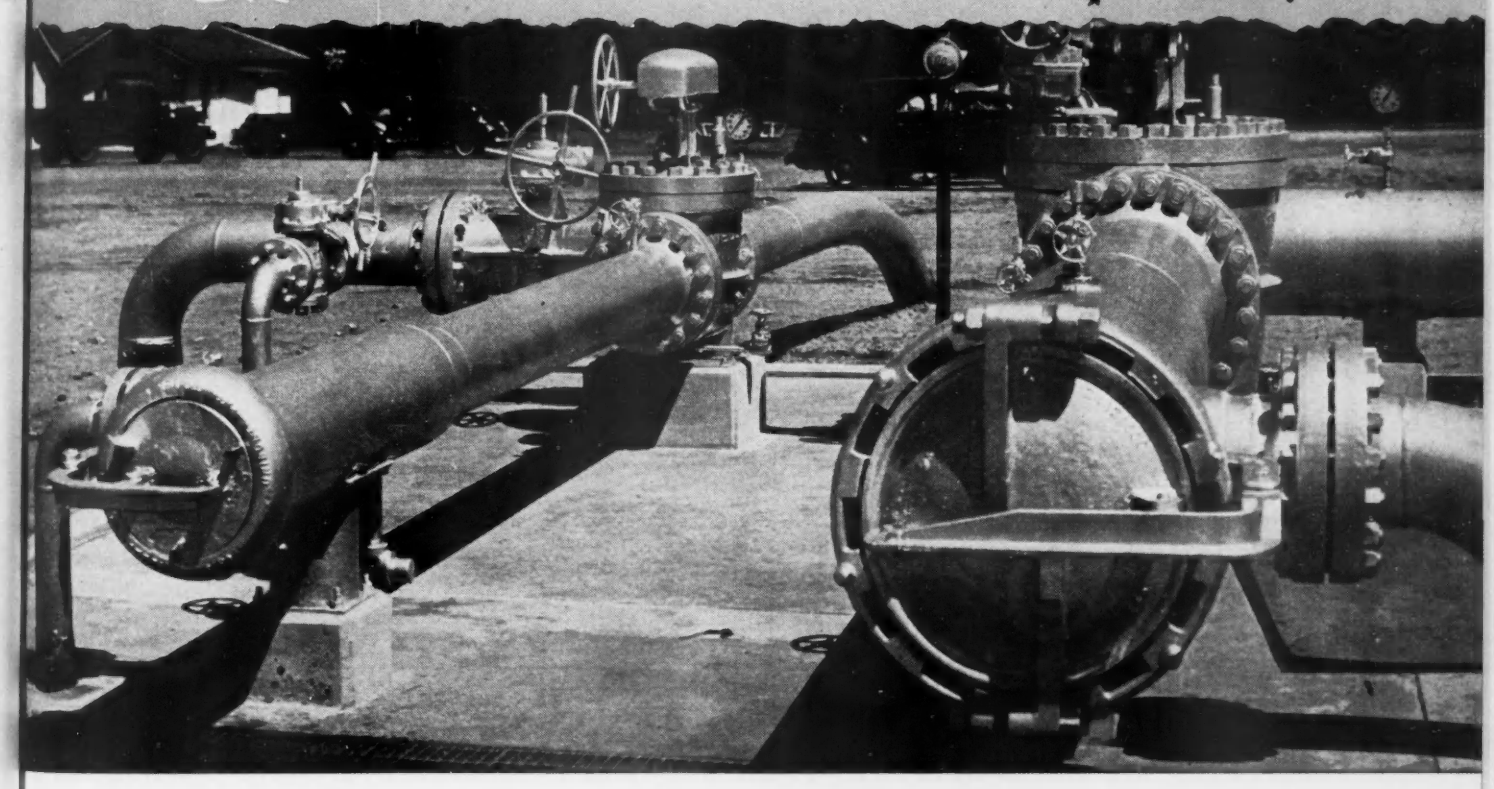


DREDGING (bottom photo): Shell reefs and shallow passages had to be dredged through in several areas to permit marine equipment and pipe line to reach Block 32. Ten of the 15 miles between shore and platform were ditched with dredge and the remaining five miles were jetted.



TYPICAL SCRAPER TRAP INSTALLATION

THE EASY WAY TO CATCH A PIG!



The oversize barrel does the trick. Note in the above sketch of a typical scraper trap installation how an oversize barrel on both the sending and receiving ends of the line provides ample clearance for the pig (which has the same o. d. as the pipe in which it is run). No sidebooms, tractors, rams and strongarm men required. Line pressure does the heavy work.

But that's only half of the story. To further simplify the job, all you need do to open the UNIBOLT Hinged Scraper Trap is release two bolts and the blanking plug swings open like a door. No heavy lifting. Nothing to fall on workmen. No time-consuming blind flanges to make up. No danger of leaks — the UNIBOLT self-sealing oil-resistant seal ring assures a pressure-tight seal.

UNIBOLT SCRAPER TRAP with oversize barrel

Wherever multi-bolt flanged couplings and closures are now being used . . . on strainers, scrubbers, mist removers, terminal manifolds, blowdowns or other pressure vessels . . . UNIBOLT Couplings will serve you better. Send for literature.

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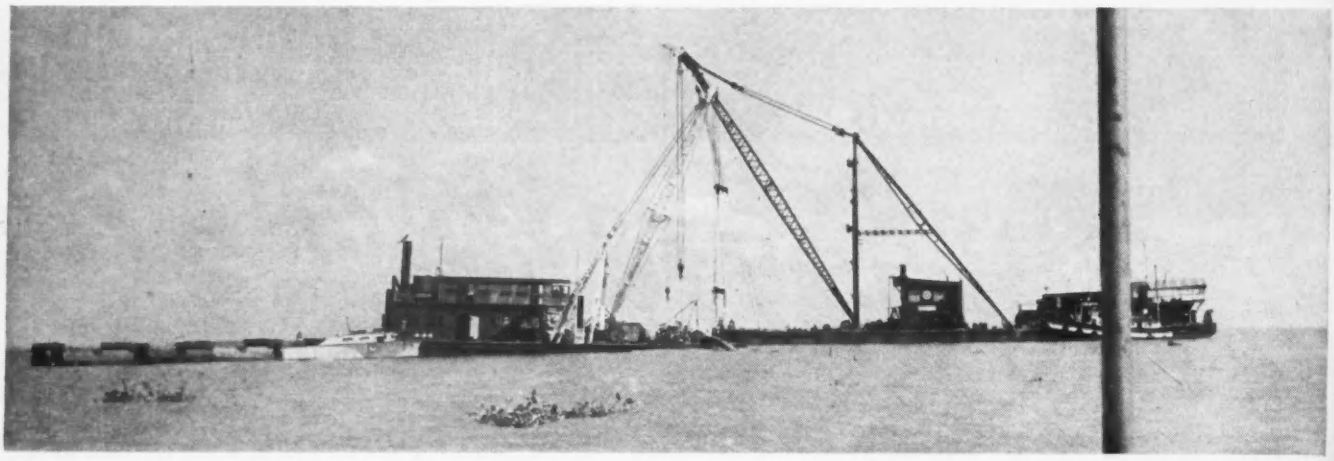
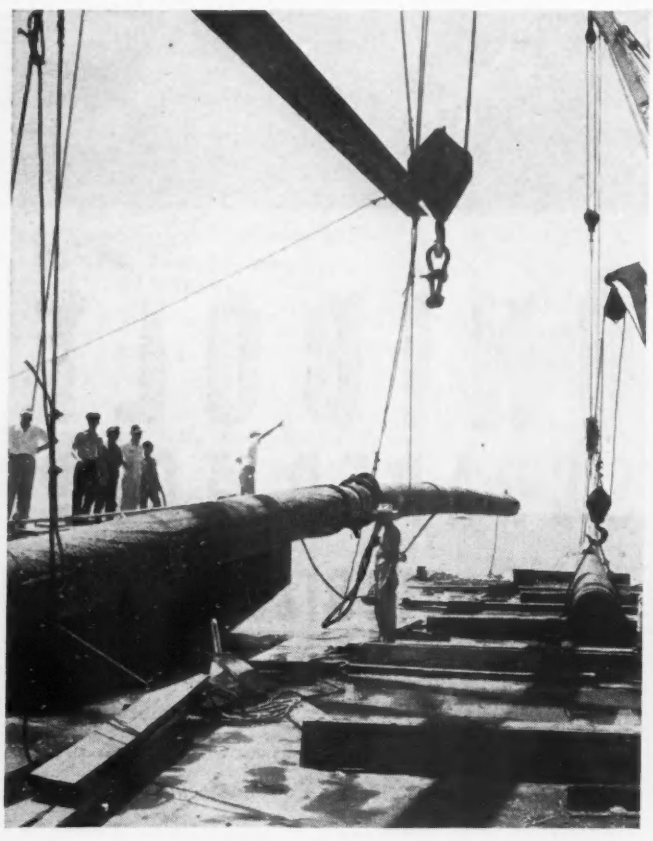
Tie-In: Huge marine equipment makes short work of difficult task

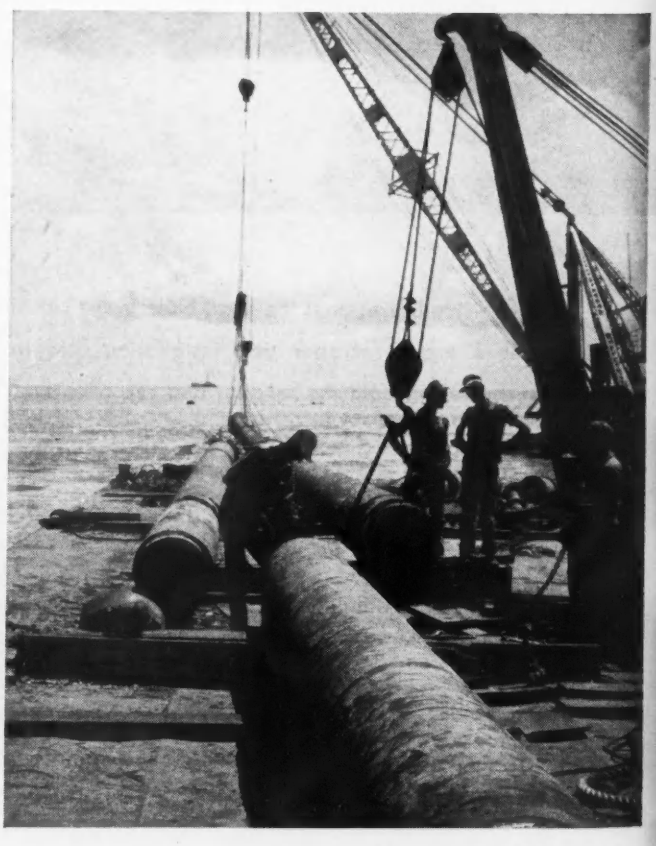


EQUIPMENT (above): Two derrick barges, a work barge, and an equipment barge are used in making tie-ins. Derricks move two sections of pipe line from the Gulf bottom onto the work barge and support the lines so they will be horizontal during cutting, fitting and welding.

WORK BARGE (lower left): One of the section ends has been hoisted onto the work barge and the bull plug beveled off. A second line which overlaps the first is coming aboard.

READY FOR TIE IN WELD (lower right): Bull plug and overlaps have been beveled off and preparations are under-way for a tie in weld.





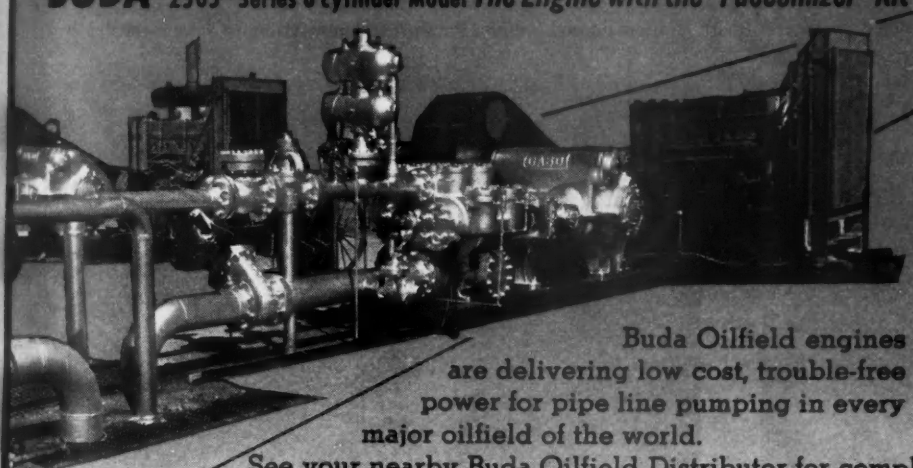
Photos on 230-232 Courtesy *United Gas Log.*

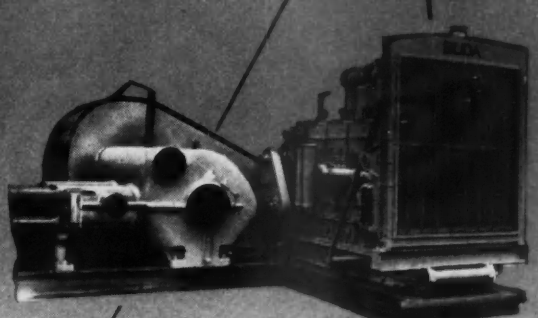
BUDA

for dependable

PIPE LINE PUMPING

BUDA "2505" Series 8 cylinder Model *The Engine with the "Fuecomizer" Kit*





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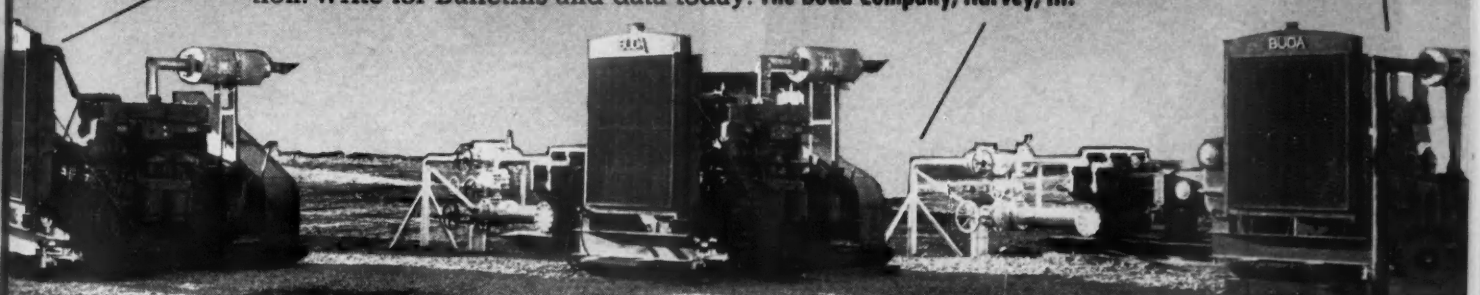
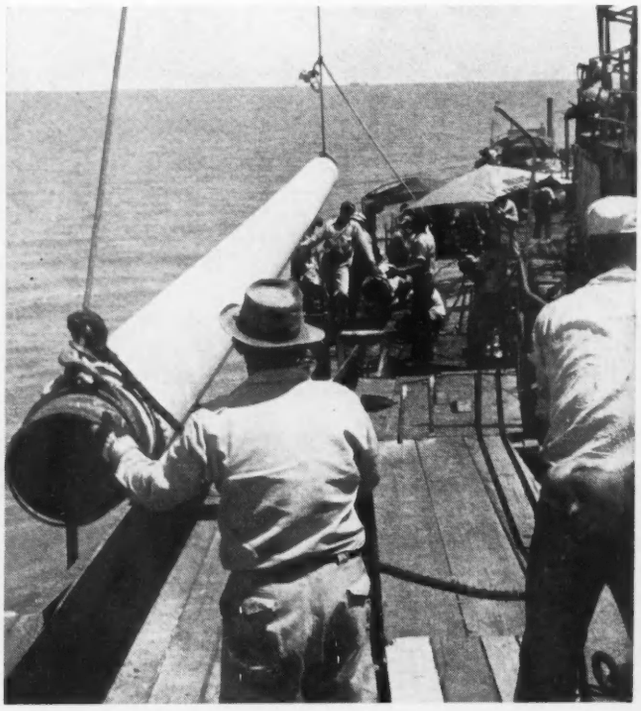


BUDA Oilfield Distributors are located in: Dallas • Tulsa • Los Angeles • Houston • Oklahoma City • Seminole • Wichita Falls • Shreveport • Bakersfield • Tinsley • Pampa • Great Bend Long Beach • Kilgore • Mt. Carmel, Ill. • Alice • Odessa • Casper • Lafayette • Artesia • Denver • Ulysses • Brookhaven • New York City (Export) and in Canada at Calgary and Edmonton

Operation 'Stovepipe': About 2000 feet every 24 hours was the average in laying 10½ miles of 14-inch pipe in the open gulf

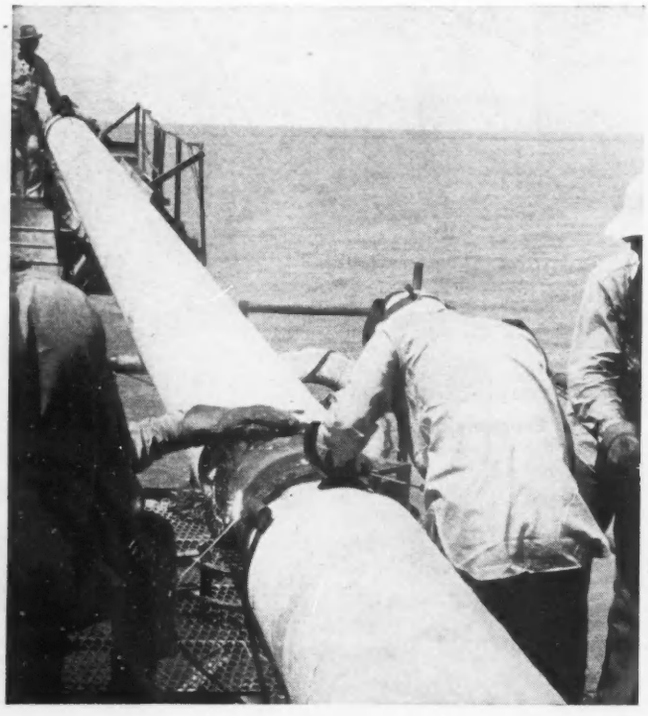


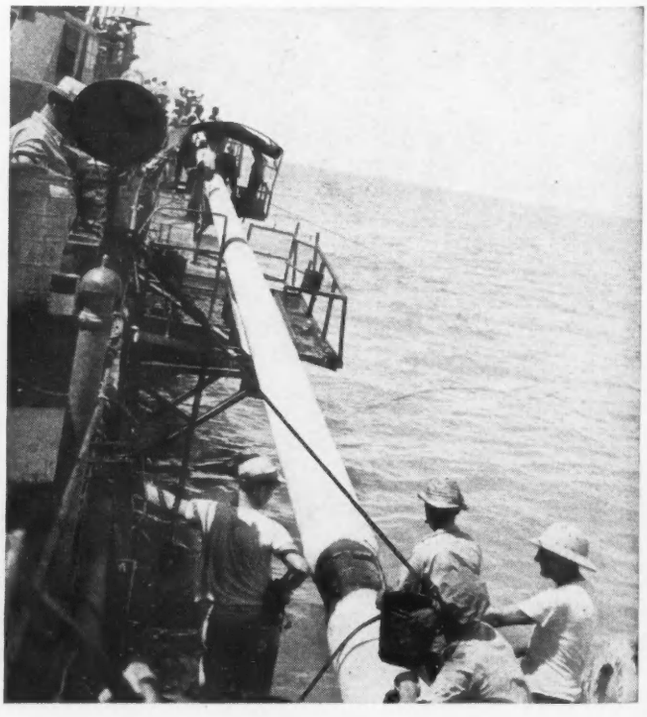
FLAGSHIP (top left): "S. S. Herman B," converted Naval barge adapted to pipe laying, deposited 2000 feet of pipe on the Gulf bottom every 24 hours with "stovepipe" or single joint methods. Four work platforms extend over the water.

PIPE ON DECK (top right): Single joints of half-inch wall, 14-inch pipe coated and concrete-jacketed at Harvey, La., are unloaded onto the "Herman B" and added one at a time to the submerged pipe line.

WELDING (lower left): Welding was completed in two steps on the ship's platforms.

COATING (lower right): Newly-finished weld was primed and covered with joint mould and fed into the Gulf to await jetting to permanent depth.





more and more pipelines use

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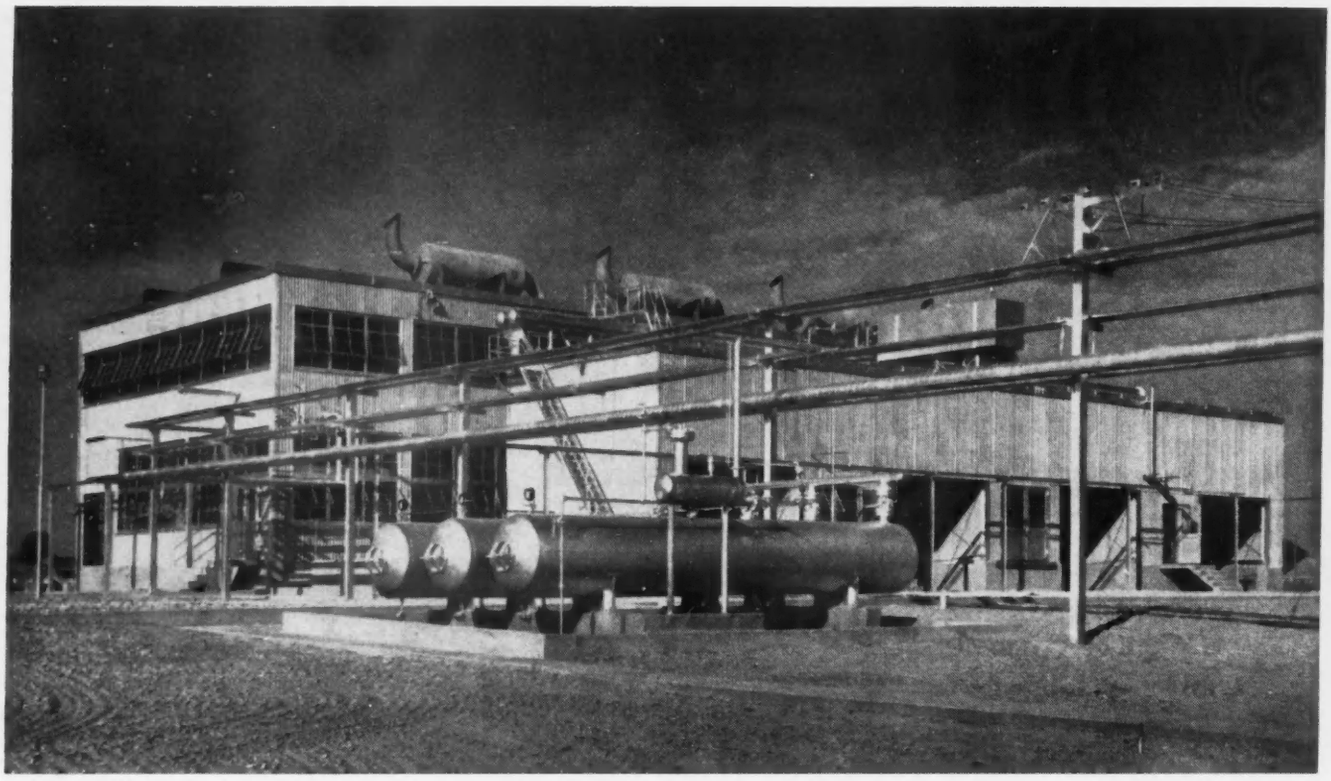
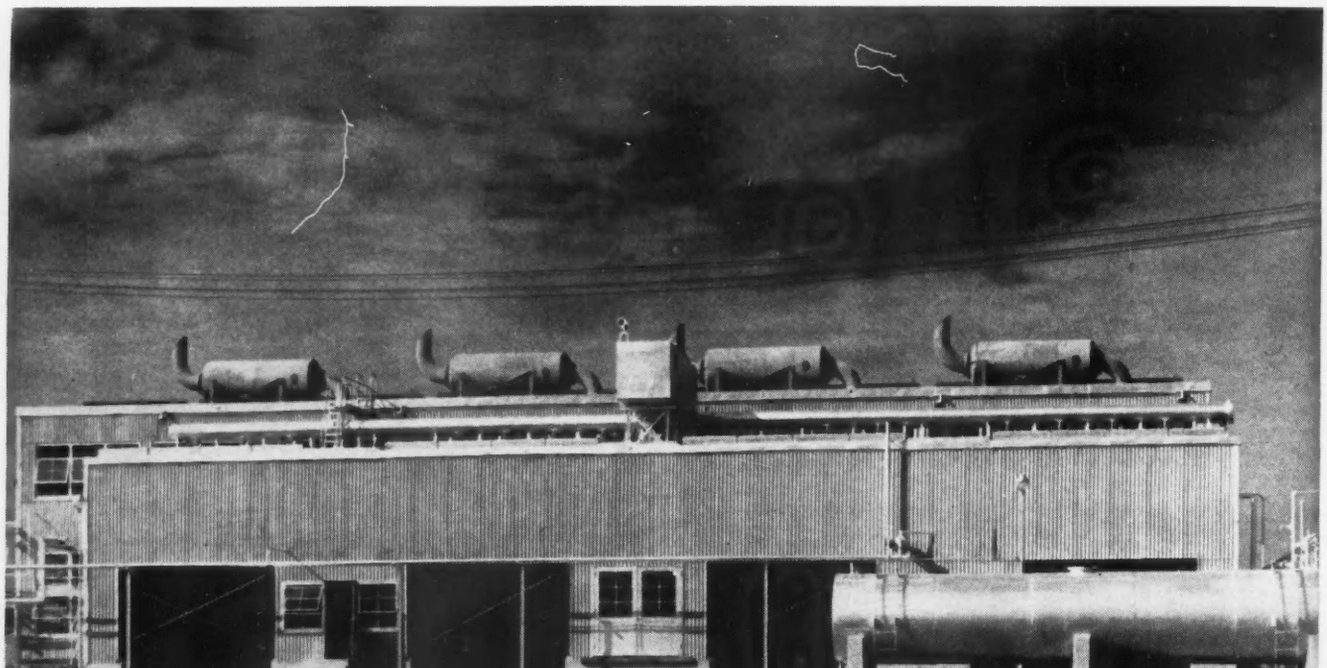
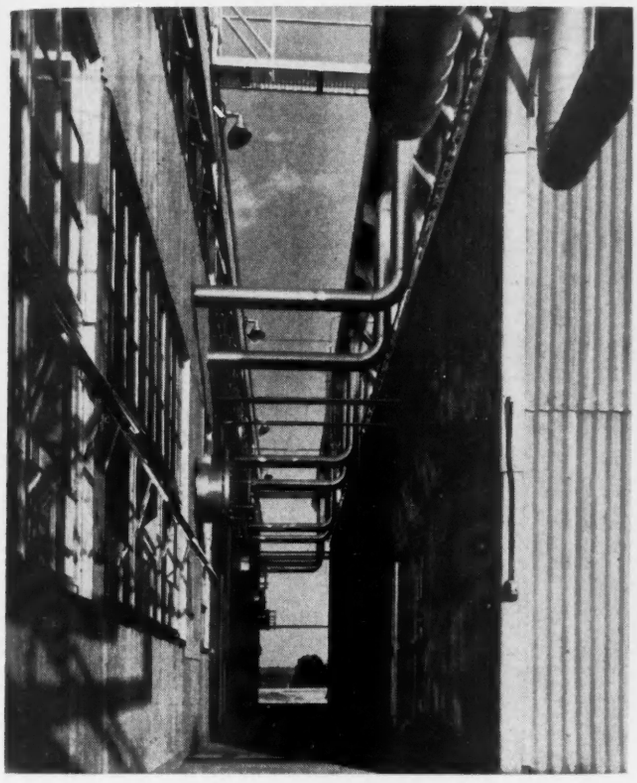


Highly unitized compressor station at Joppa, Ill., where compressor engine drives jacket water pumps, fans on atmospheric cooling sections.

Careful Planning Precedes Speedy



Open bays in building in foreground are air intakes for jacket water atmospheric cooling sections. Spaces between sections are utilized for storage, showers, and meter rooms.



LEFT: Building at left contains four 2000 horsepower compressor engines. Building at right houses atmospheric cooling sections, meter runs, storage space and shower room.

RIGHT: Closeup of cooling fan. Power is transmitted directly from engine by shaft and angle drive.

Construction of Trunkline System

ONE year, four months and 27 days after the Federal Power Commission granted a certificate for construction of a 1300-mile natural gas pipe line system from McAllen, Texas to Tuscola, Ill., The Trunkline Gas Company commenced deliveries.

Date of the FPC certificate was May 4, 1950. Between this date and October 1, 1951, Trunkline set up a complete construction and engineering organization, completed aerial and on-the-ground surveys of the entire route, acquired rights-of-way and materials, let contracts and completed construction of the system, to deliver gas at its northern terminus. Actual laying operations of the line were completed August 9, 1951.

Despite the unprecedented speed with which the system was completed, careful planning and painstaking engineering were incorporated in its design. Several unique design features were built into the compressor stations.

- Compressor engine driven jacket water pumps.
- Compressor engine driven fans on atmospheric cooling sections.
- No discharge gas cooling.
- Maximum utilization of space.

THIS NEW SYSTEM was completed in less than a year and a half after Federal Power Commission issued a certificate authorizing its construction. Despite this unprecedented speed in acquiring rights-of-way, materials and personnel, Trunkline was able to incorporate careful planning and painstaking engineering into the system design.

Intial delivery capacity of the 26-inch line is 250 million cubic feet per day, of which all but 1½ million will go to Panhandle Eastern Pipe Line's Tuscola compressor station. The remainder will be delivered to Southeastern Illinois Gas Company for distribution at Metropolis, Ill.

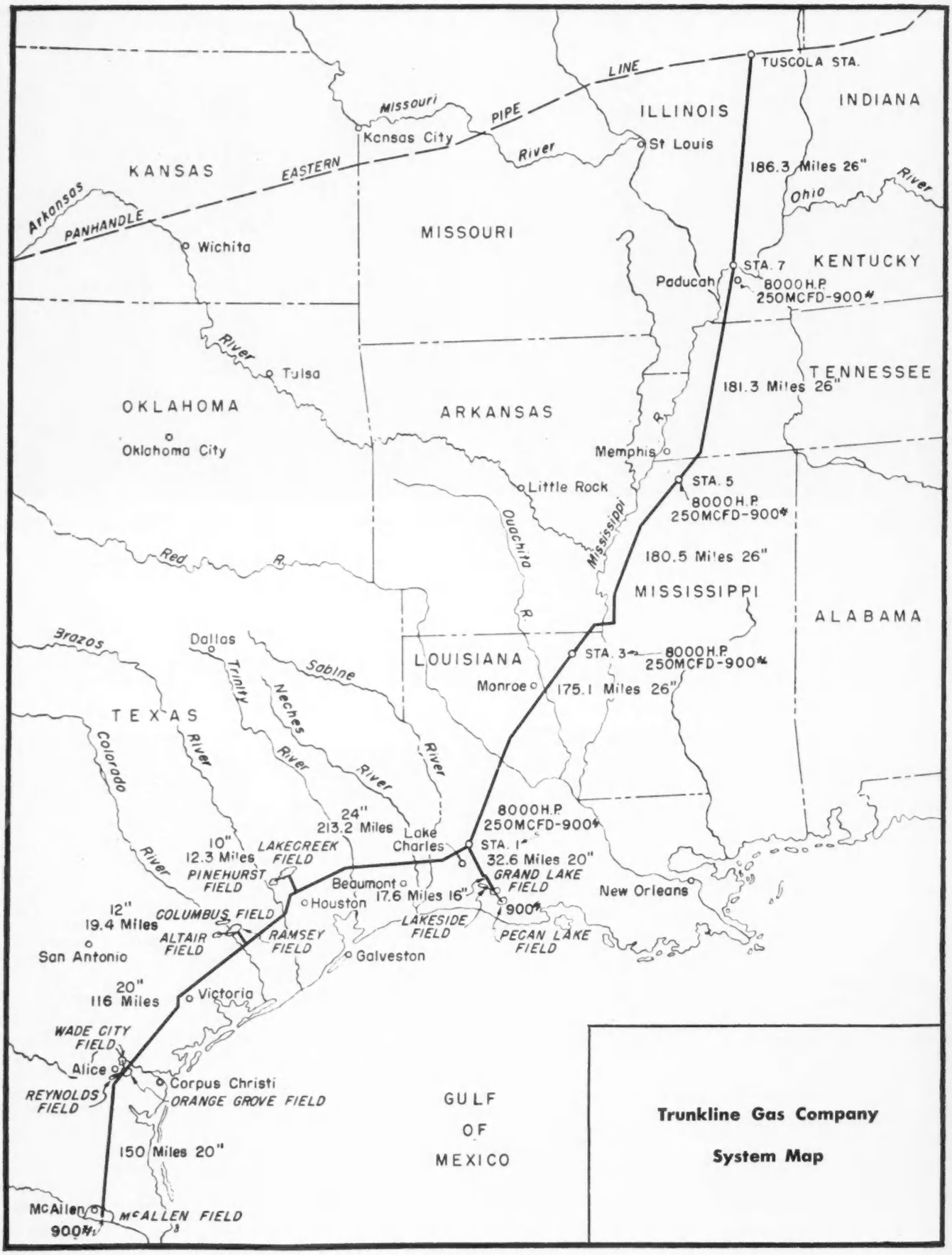
One of the most difficult aspects of a project of this nature is acquisition of right-of-way. In traversing the 1300 miles from the Rio Grande Valley in Texas, to its terminus at Tuscola, the line goes under and through, truck gardens and citrus groves in the Rio Grande Valley; ranch lands, rice fields, timber areas in the balance of Texas; swamp lands, timber tracts and farm lands in Louisiana; the Delta Cotton country of Mississippi, Arkansas and Tennessee; cattle and farm lands in Kentucky; and the coal fields and farm land area of Illinois.

Over its route, the line crosses the Colorado, Brazos, Trinity, Neches, Sabine, Calcasieu, Red, Ouachita, Mississippi and Ohio rivers plus numerous minor rivers and creeks.

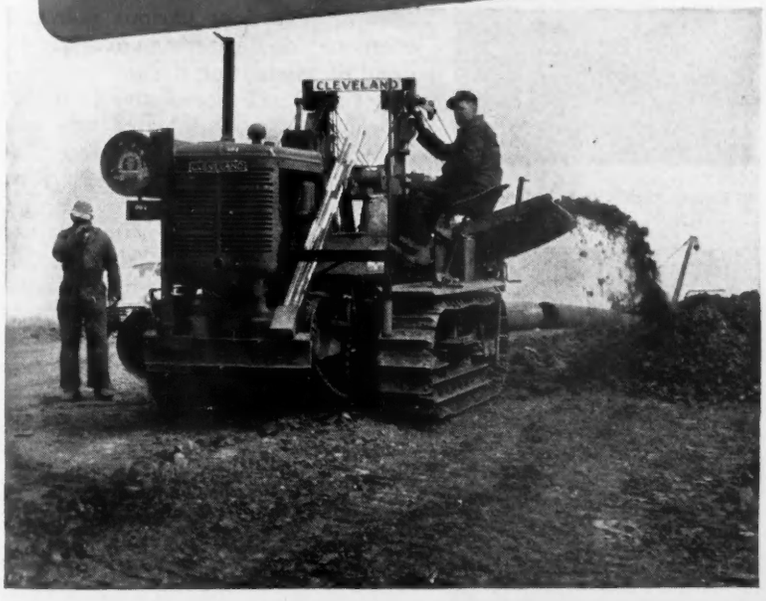
Right-of-way across 3343 tracts of land were obtained from 2861 owners. Tenants occupied 1187 of these tracts of land. There were 415 estates, with 3201 heirs also involved in the right-of-way problem.

Design of Line

The design of the line and stations


TUSCOLA STA.
LINE
PIPE
EASTERN
PANHANDLE
Missouri River
Arkansas River
Ohio River
Red R.
Ouachita R.
Mississippi
Brazos
Trinity River
Sabine River
Neches River
Colorado River
Kansas City
St Louis
Wichita
Tulsa
Oklahoma City
Dallas
Houston
Beaumont
Lake Charles
Monroe
Memphis
Little Rock
Paducah
Galveston
Victoria
Alice
Corpus Christi
San Antonio
McAllen
New Orleans
KANSAS
MISSOURI
ILLINOIS
INDIANA
KENTUCKY
TENNESSEE
OKLAHOMA
ARKANSAS
MISSISSIPPI
ALABAMA
LOUISIANA
TEXAS
GULF OF MEXICO
186.3 Miles 26"
181.3 Miles 26"
180.5 Miles 26"
175.1 Miles 26"
STA. 7
8000 H.P.
250 MCFD-900#
STA. 5
8000 H.P.
250 MCFD-900#
STA. 3
8000 H.P.
250 MCFD-900#
STA. 1
8000 H.P.
250 MCFD-900#
24" 213.2 Miles
10" 12.3 Miles
12" 19.4 Miles
20" 116 Miles
32.6 Miles 20"
17.6 Miles 16"
150 Miles 20"
900#
LAKECREEK FIELD
PINEHURST FIELD
COLUMBUS FIELD
ALTAIR FIELD
RAMSEY FIELD
LAKESIDE FIELD
GRAND LAKE FIELD
PECAN LAKE FIELD
WADE CITY FIELD
REYNOLDS FIELD
ORANGE GROVE FIELD
McALLEN FIELD
Trunkline Gas Company
System Map

Check these CLEVELAND "EXTRAS"



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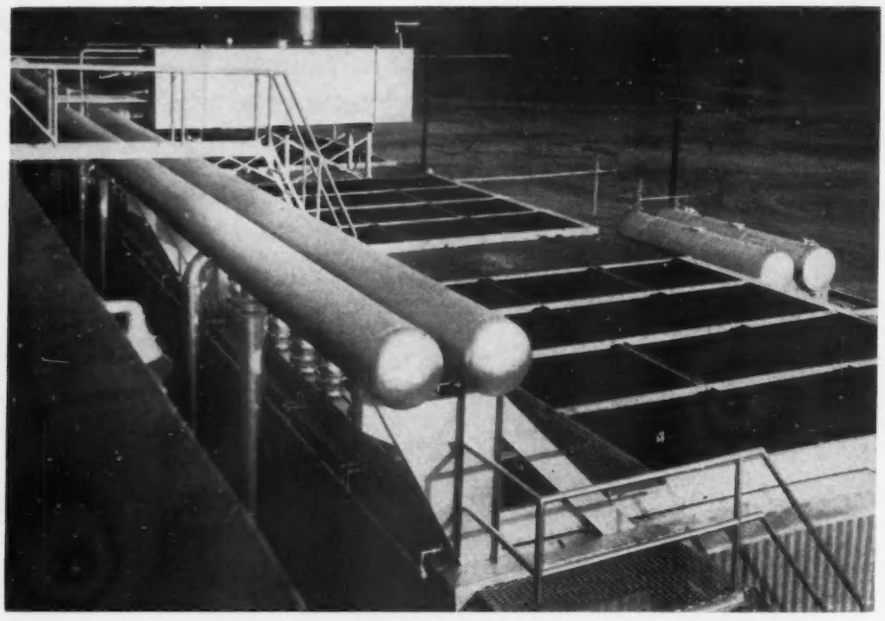
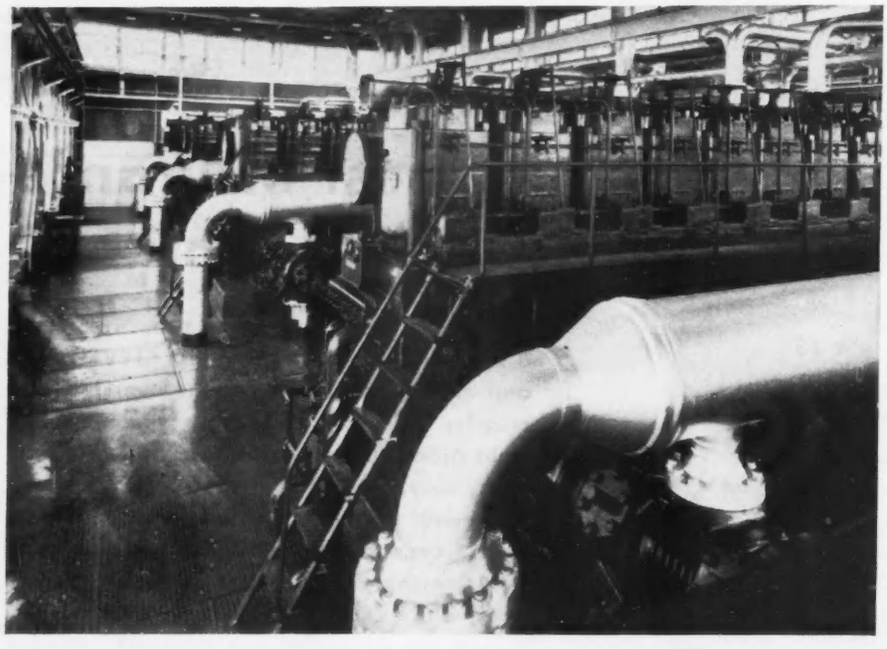
Extra low ground bearing pressure (only 6 lbs. per sq. in. in the biggest CLEVELAND) and extra traction through the oversize full-crawler mounting that keep you stepping right along through mud, swamp, sand and sticky clay. Extra power that pays off when "all-good" digging turns into rock, hills and hard frozen ground. Extra heavy-duty construction that cuts costly maintenance down-time, while CLEVELANDS famous "unit-type" assembly allows the few necessary repairs to be made quickly and easily in the field. Extra-low center of gravity that means perfect sure-footed balance on the steepest grades and broken country. Extra maneuverability for easy handling in built-up areas. Extra-long service life that slices your equipment overhead. And extra speed and capacity that set a dependable faster pace for your whole spread. See your local distributor today and put this CLEVELAND "insurance" to work for you. The Cleveland Trencher Co., 20100 St. Clair Avenue, Cleveland 17, Ohio.

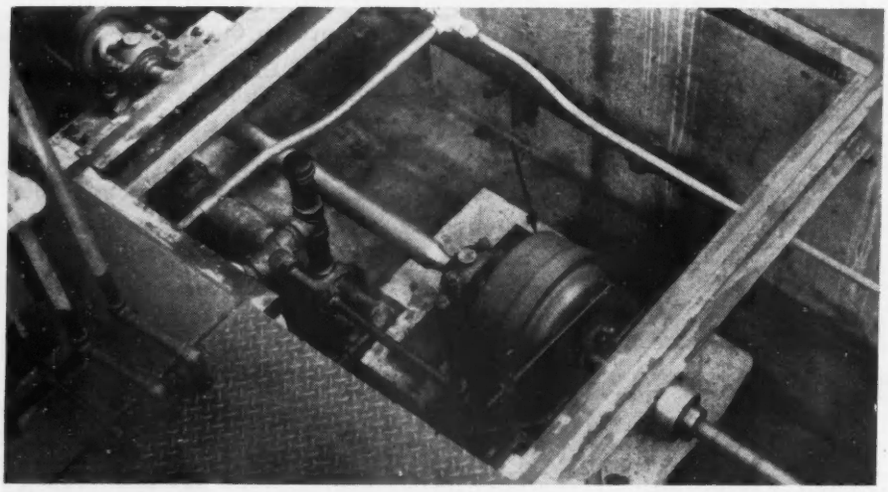
CLEVELAND TRENCHERS



Atop cooling building, 20-inch jacket water headers feed cooling sections denoted here by ribbed section of roof. Gravel section is roof of meter room. Rectangular surge tank is in background.



Interior of compressor building. Drives for fans are beneath floor plates. Jacket water pumps are integral part of each engine.



Closeup of direct driven shaft beneath compressor building floor. Arrow points to hydraulic coupling.

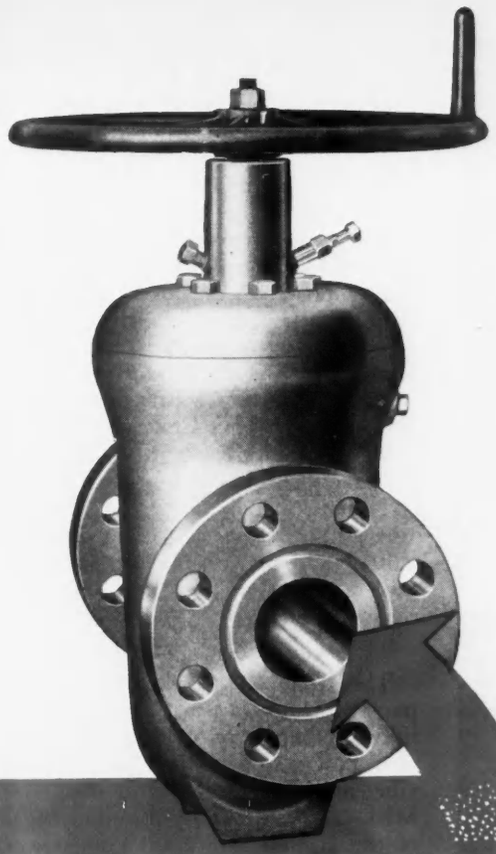
follows proved methods and practices utilized by the pipe line industry for years, although several innovations and improvements were incorporated. Design of the line is for 900 pounds per square inch pressure. Pipe used on the 26-inch section is 26-inch outside diameter x 5/16 inch wall, of electric submerged arc welded construction, having a minimum yield strength of 52,000 psi and buried in a 56-inch minimum depth ditch.

To protect the line against corrosion, a coal tar base enamel was applied to a thickness of 3/32-inch and reinforced with glass wrap imbedded in the hot enamel. A spiral wrap of heavy paper covered the outside of the coated pipe. Each section of line, for a distance of approximately 25 miles on the discharge side of each compressor station, was wrapped with a 15-pound tar impregnated asbestos felt to prevent damage or sagging of the paint in the event of high gas temperatures.

The line required approximately 275,000 tons of steel, which was shipped in 11,000 carloads, and 800,000 pounds of welding rods. Checks of various kinds included mobile X-ray units for the more vital welds and as many of the straight line welds as possible. Approximately 13 percent of all the line welds were X-rayed. All river crossing and compressor station welds were X-rayed.

Construction of the river crossings represented an innovation, particularly with respect to weighting the line in rivers. Pipe used in submerged river crossings is normally weighted with cast iron or concrete river clamps. placed at various points to overcome the water's buoyancy. Instead of calculating normal weight of water in the design of the Trunkline crossings, 85-pound water was used for the design, and a reinforced concrete jacket approximately three inches thick was placed by the guniting process over the entire length of the river lines. This method is considered superior because it gives equal distribution of the weight, increases the lateral strength of the pipe, protects the coating during installation, and resists any scouring effect which might occur if the line became exposed. Lines across all major rivers are buried to a minimum of 15 feet below the bottom.

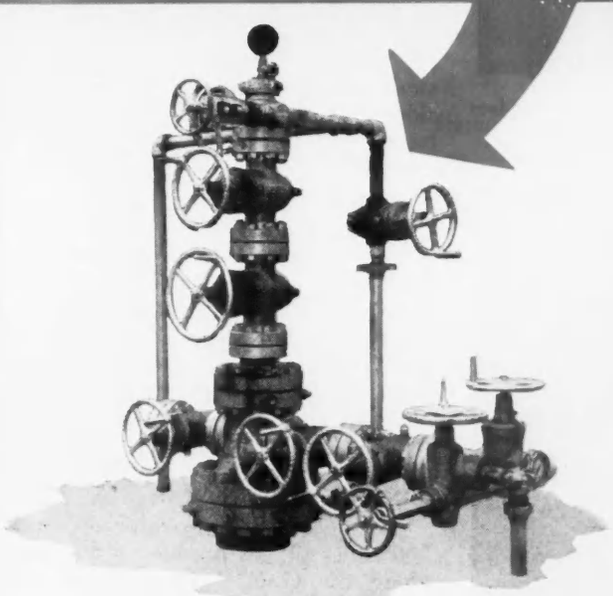
In crossing the Mississippi River, 8,394,000 cubic yards of material was dredged from the bottom and approaches to the river for the installation of two 24-inch lines. Two 24-x½-inch wall, seamless steel pipes, both curved upstream, were laid across all major rivers.



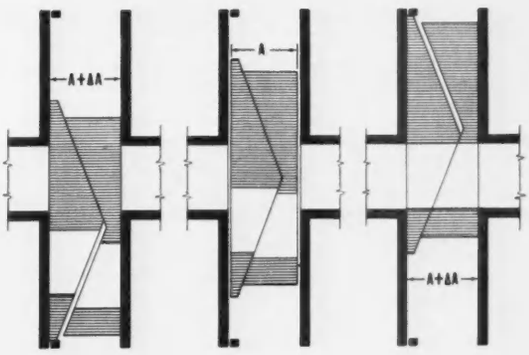
NO TURBULENCE HERE

means long valve life...

low maintenance here



W-K-M Valves have a perfectly smooth bore which has about the same resistance to fluid flow as an equivalent section of smooth wall pipe. There are no cavities or projections to cause destructive turbulence or to collect sediment. The gate and the seats are fully protected against cutting or damage of any kind. These operating advantages are a result of the W-K-M Expanding Gate development which is illustrated below.



In closed position, the gate (left) and segment (right) seal tightly against both seats.

When opening or closing, the gate and segment are in neutral position, permitting free upward or downward movement of the gate assembly.

When open, the gate and segment again seal tightly against both seats and the bore of each lines up perfectly to provide a smooth, turbulence-free passage.

The W-K-M Expanding Gate design also provides free-running opening and closing under full rated pressure and gives extremely high seating pressures. For easy operation, W-K-M valves also have superfinished stems, double thrust bearings and precision ground stem threads.

These engineering and operational features are among the reasons why 80% of the world's high-pressure wells are controlled by W-K-M valves. Specify W-K-M when you want sure, positive control all over your Christmas Tree.

W-K-M COMPANY

P. O. BOX 2117 HOUSTON 1, TEXAS

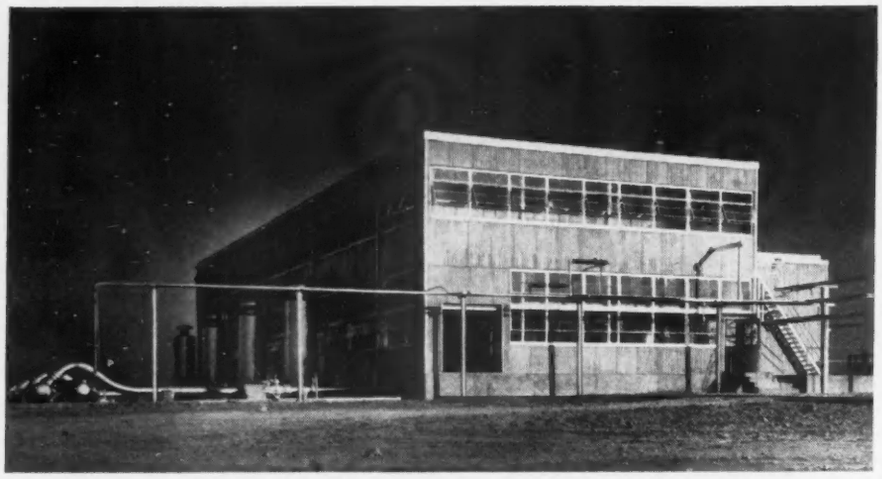
727 W. SEVENTH STREET, LOS ANGELES, CALIF.

EXPORT OFFICE: 30 Rockefeller Plaza, New York, N. Y.

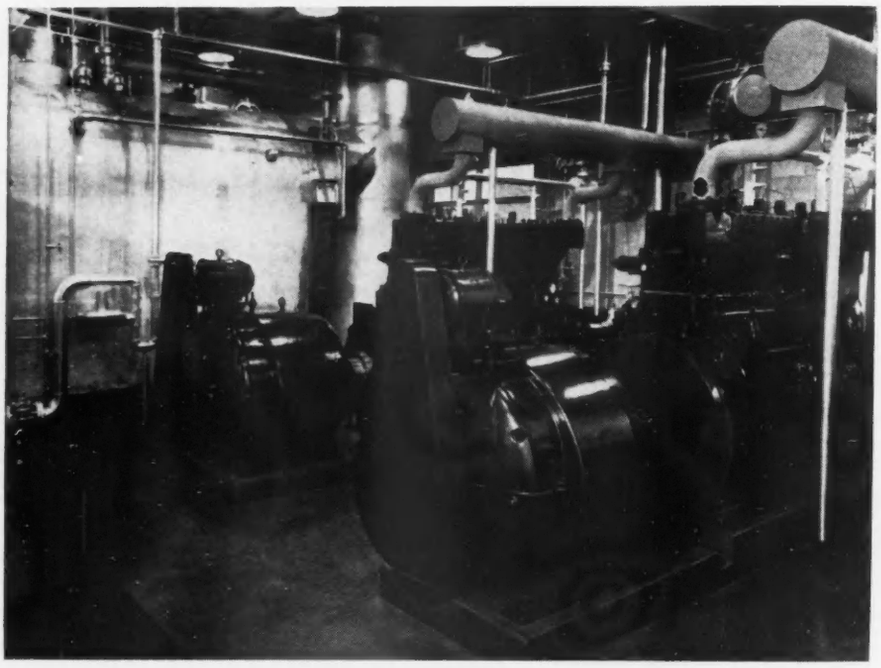
W-K-M *Valves*

ALL W-K-M VALVES HAVE **Through-Conduit Fluid Passage • Parallel Expanding Gate Assembly**

Oversize Replaceable Seats • Pressure Seal Bonnet • Double Row Thrust Bearings on Stem • Internal Lubrication



Discharge side of compressor building. Because discharge gas is not cooled before entering pipe line, special insulation is used for first 25 miles from station. Note large intake air filter-silencers.



Small generators supply ample current for plant's operation, since jacket water and cooling fans are engine powered. Boiler in background furnishes heat for buildings and offices.

Storage space between cooling sections.

In laying the line and river crossings, The Mahoney Construction Company of Lansing, Mich., laid 187 miles of 26-inch; R. H. Fulton Company of Lubbock, Texas, laid 179 miles of 26-inch, 264 miles of 20-inch, and installed the Colorado and the Brazos river crossings; Anderson Brothers of Houston laid 182 miles of 26-inch, 211 miles of 24-inch, and installed the Trinity, Neches, Sabine and Calcasieu river crossings in addition to laying the Mississippi River crossing on a joint contract with McWilliams Dredging Company of New Orleans; The Houston Contracting Company of Houston laid 173 miles of 26-inch line, plus some of the lateral supply lines; the J. Ray McDermott Company of Harvey, La., installed the Ohio, Red and Ouachita river crossings.

Compressor Stations

The Tellepsen Construction Company of Houston constructed the four initial compressor stations of 8000 horsepower each. These are at Longville and Epps, La., Independence, Miss., and Joppa, Ill. Engines in all of the stations are 2000 horsepower.

The compressor stations utilize a unitized design in that the main compressor engines supply all power except for lighting. The engine jacket water is cooled through a radiator type of structure, the fan for which is driven through shafting from the main engine. The pump for circulating the water through the coils in the tower is geared directly to the engine. Engine lubricating oil is cooled in a heat exchanger which utilizes the suction gas for cooling purposes. All piping at the compressor stations is carried overhead instead of underground. This is considered an important safety step, plus having the advantage of greater accessibility.

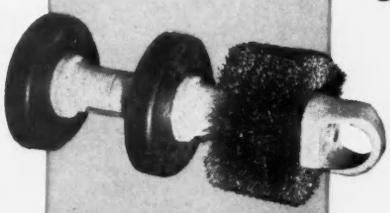
Gas Supply

Trunkline Gas Company has purchase contracts with several companies for its supply of gas, reserves of which are estimated to be 2 trillion cubic feet. This gas will come from the Grand Lake, Pecan Lake, and Hurricane Creek fields in Louisiana; and the Lake Creek, Pinehurst, Altair, Columbus, Ramsay, McAllen, Orange Grove and Wade City fields in Texas.

The line travels through more than 500 miles of gas-producing territory along the Gulf Coast of Louisiana and Texas. This further assures Panhandle Eastern Pipe Line Company of an adequate supply of natural gas for its customers and a life expectancy at least equal to any major gas transmission company.

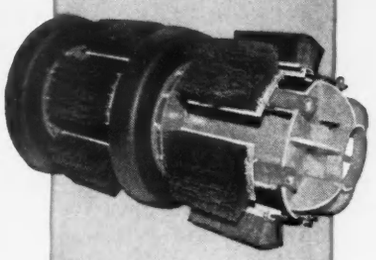
Williamson Pipe Line Products

— STANDARD for the INDUSTRY —

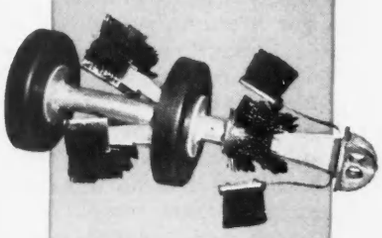


PIGS FOR CLEANING

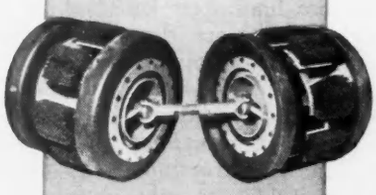
← Small diameter lines type JR, 2" to 5".



← Large Oil & Products Lines, 16" to 30", Type GP-4, Brushes expanded by arched springs.

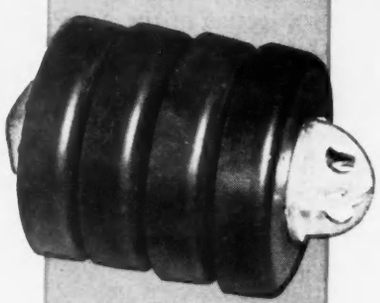


← 6" to 14" diameter lines. Type WC-11, Brushes expanded by spring steel arms.



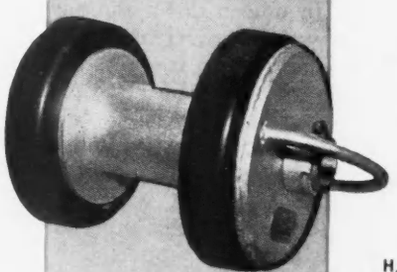
← Large Natural Gas Lines, 18" to 30" sizes. Type GP-3, Brushes expanded by arched springs.

PIGS FOR SEPARATION



← and displacement of fluids. Sizes 3" to 30". (Available with Noise Maker). Type SBN-4.

PIGS FOR GAUGING



← new liquid lines, propelled by compressed air. Type SG-2 with stellite-edged sizing plate.

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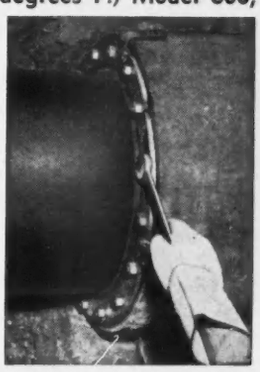

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(1) Protect pipe coating against damage.

(2) Insulate line pipe from casing.

(3) Center pipe in casing to facilitate bushing installation.

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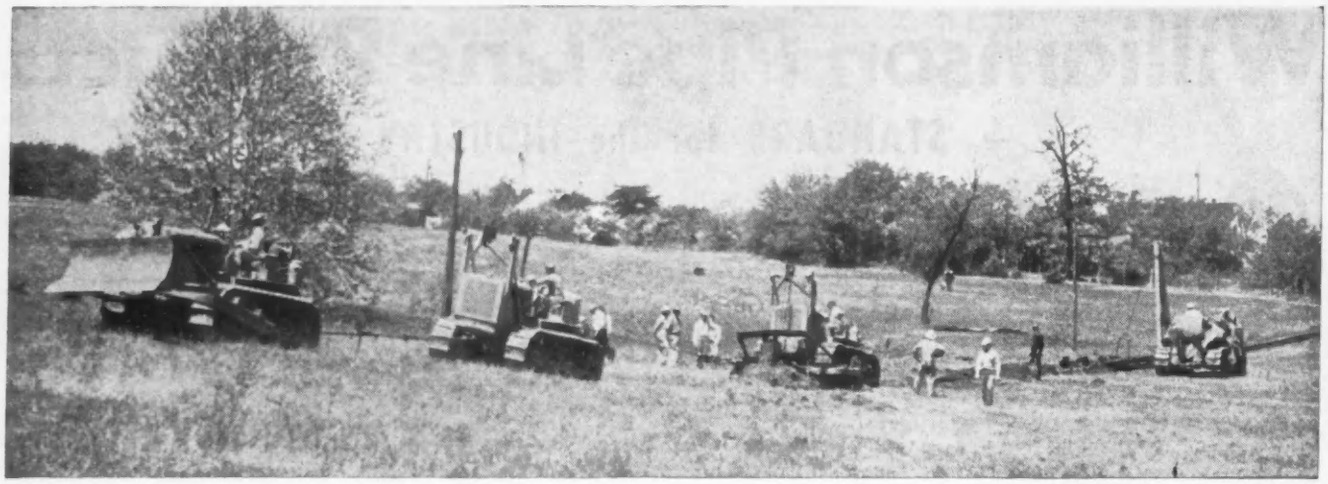


Reclaiming equipment—all four tractors in line.

New Technique Speeds

Pipe Reclamation

By T. W. BELT

Engineer, Interstate Oil Pipe Line Company, Tulsa

A NEW pipe reclaiming technique which averaged about three miles of line per day—and under good conditions, five miles—was used by Interstate Oil Pipe Line Company crews in the rugged terrain of southeastern Oklahoma. Machines used for the first time in this type of work recovered 78½ miles of eight-inch and 22¼ miles of six-inch pipe.

Interstate applied the method on a section of threaded and coupled pipe line known as Council Hill-State Line Discharge. Originally laid in 1910, the line was looped in 1915 and again in 1923. The lines cross the Sans Bois, Winding Stair and Kiamichi mountains in Southeastern Oklahoma (see map). These ranges are low, but very steep in places, having vertical drops of 10 to 20 feet and 45-degree slopes extending for 100 feet or more. When the lines were installed, individual joints were dragged to the right-of-way by teams; sometimes it took one full day for a team to drag one joint into location.

A contract was let to Standard Pipe Line Construction Company of Cushing, Okla., to take up and recondition a section of the No. 2 line, and work was begun in April, 1951. Knapp Bros., pipe line reclaimers of Oxford, Kansas, subcontrated to place the line on top of the ground.

Knapp used a heavy bulldozer for clearing right-of-way behind the fence crew. A back hoe followed, stripping out portions of right-of-way inaccessible to reclaiming equipment.

Four tractors coupled together and moving in unison down the right-of-way powered the reclaiming equipment. The first two tractors served as tow tractors. The third tractor carried a special plow mounted on a bulldozer blade frame. A tailend winch line was attached to the pipe reclaimer. A 60-foot wire rope attached to the reclaimer pulled a pipe cradle which was supported by the side-boom of a fourth tractor.

The plow on front of the third tractor pratically uncovered the pipe. The reclaimer followed about 30 feet behind the third tractor, traveling beneath the pipe. Blades on either side extended above the pipe, to cut sides of the ditch. One blade, nine inches

Passing over rough spot. Notice plow point, temporarily out of ground.

wide and five feet long, was hinged to the shoe on each side of the pipe and fastened at one end with a hook attached to a winch line. Front edges of the shoe and blades were sharpened for cutting through the earth. A 30-foot long wedge-shaped elevator followed the shoe. This elevator had a two-foot rise through its 30 feet length.

Length of the wire rope attached to the cradle varied, depending on depth of the pipe. The cradle was carried by the side boom in such a position that the pipe was deposited on top of the ground at one side of the ditch.

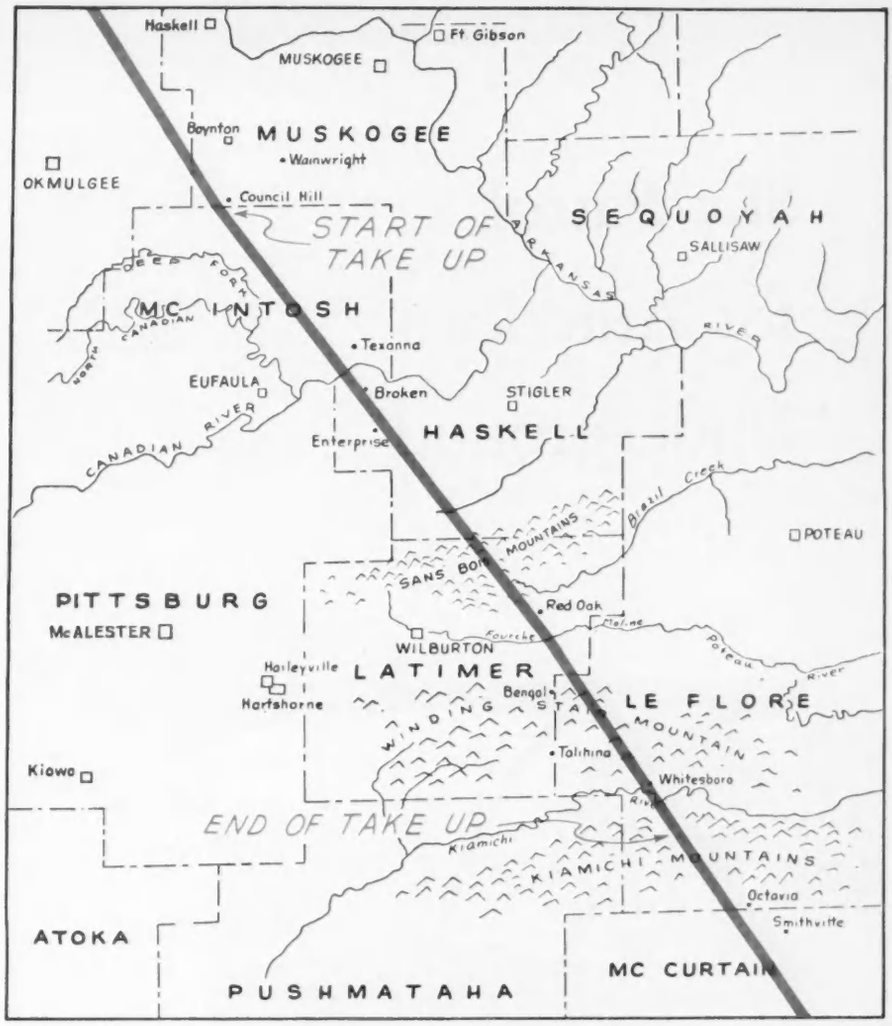
At road crossings and where cover above the pipe was exceptionally deep, the pipe was cut and pulled out. One or both winch tractors were used to pull the section clear. The bulldozer backfilled road crossings, then overtook the other tractors which had gone ahead. To expedite this type of work, cutting equipment was carried on the side boom tractor.

Difficulties arose where company telephone line poles were too close to the pipe to permit normal operation. The reclaimer was coupled to a winch tractor and the plow tractor and bulldozer tractor operated together, stopping and going around each pole. Reclaimer, elevator and cradle followed, continuing to take up the line even though it rested against some of the poles. Little or no damage to the poles resulted.

There was little ditch left to backfill, because most of the dirt fell back in place when the line was removed. The dirt remaining above the ditch was equally distributed on both sides. An angle bulldozer was used for backfilling. A farm tractor followed, pulling a disk to loosen the packed ground. A fence building crew brought up the end, leaving all fences in good condition.

A cutting crew followed immediately behind the take-up crew, cutting the line into 40-feet lengths.

O. L. Harvey Truck Service of Seminole, Okla., subcontracted to haul the pipe into the reconditioning yards. Because of the steep hills on some sections of the line, it was necessary to drag the pipe to a place on the line accessible to the trucks. A two-wheel cart was constructed to speed up the dragging operation. This cart was made similar to a logging arch, having no axle but a heavy arch 6 feet wide by 6 feet high with a pulley set in the top. A Y-type tongue further braced the wheels and had a swivel connection for fastening to the tractor draw bar. A winch line from the tractor went through the sheave in the top of the arch and supported the load. A side boom tractor was used to rack the joints in piles so the arch could be backed over a pile and hooked on. Dragging time was cut to one-third by the use of this arch.



The line was divided into four sections with a separate pipe yard for each section. Only one day was lost in moving from one yard to the next. Each yard was set up so that the pipe went straight through from incoming rack to finish rack where trucks then hauled it to the railroad. A double head cleaning machine was used with very good results.

An interesting sidelight is that 24,692 collars were sold with the threaded nipples still intact, producing revenue estimated at three times their junk value with no increase in salvage cost.

Table 1 gives the amount of pipe and saleable collars recovered from the take-up.

Table 1

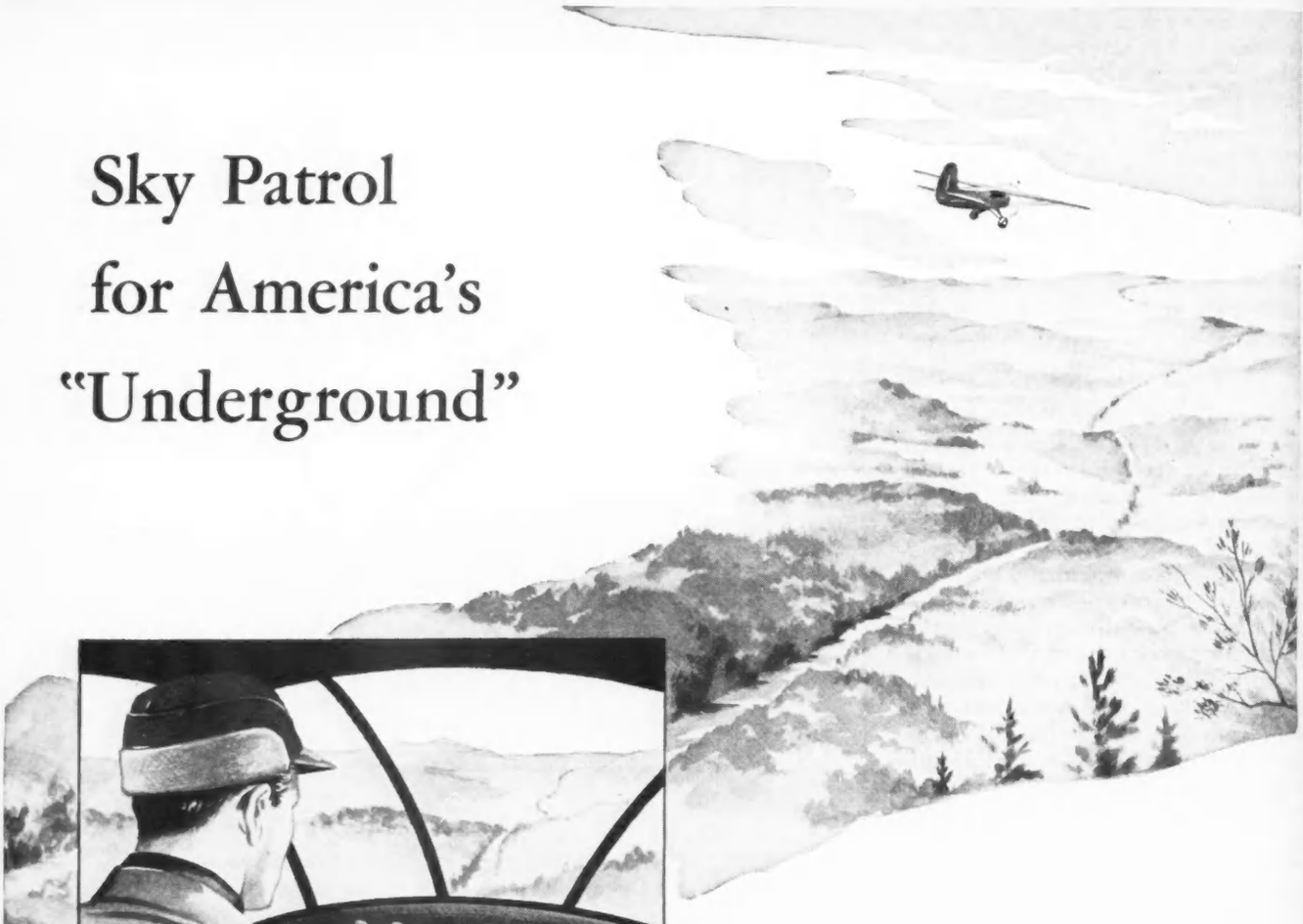
	8" Line	6" Line
Length of Line	78½ mi.	22¼ mi.
Good Pipe	72 percent	75 percent
Fair Pipe	21 percent	19 percent
Junk Pipe, Cuttings and Collars	7 percent	6 percent
Good Collars Recovered	19,385	5,307

An average of 1½ miles per day was taken up and run through the yard, including time shutdown because of bad weather.

About the Author

T. W. BELT received a B.S. degree in mechanical engineering from Virginia Polytechnic Institute in 1939. He worked for Mene Grande Oil Company, C. A., in Venezuela and Plantation Pipe Line Company before joining Interstate Oil Pipe Line Company in 1947.

Sky Patrol for America's "Underground"



Hedgehopping pilots patrol the world's longest pipe line through thick and thin weather. Flying low over open country—1800 miles between Texas and New York—they can follow the underground pipe by changes in vegetation and other signs known only to practiced observers. They are trained to look for trouble . . . get quick action if anything goes wrong.

But in thousands of hours' flying, these air inspectors rarely find trouble. For pipe lines operate under infinite safety precautions. Back at the mill the pipe was double-welded, x-rayed and subjected to terrific hydrostatic pressure. Independent engineers made sure that it met specifications.

Before it was put in the ground, all pipe was again inspected and coated to guard against corrosion. Before operating, tests were made at higher than operating pressures. During operation, mobile ground crews, with radio contact, maintain watch over every mile. Safety devices automatically isolate trouble along the line and at all operating facilities. To provide instantaneous communication, a microwave radio system spans the entire length of the line.

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Economic Factors Involved In Looping vs. Boosters

By N. B. MAVRIS

Engineer, Continental Pipe Line Company, Ponca City, Okla.

MANY pipe line companies are faced with increased delivery requirements and the problem of resolving upon a method of increasing capacity of an existing system. Increase capacity to any extent requires one of three methods:

- Adding booster stations or horsepower
- Adding parallel lines or loops; and
- Replacing small lines and extending booster station spacing.

Choice of which method to use in increasing capacity depends primarily on economic payout. Other considerations are size of lines used in the initial system, size of increase, characteristics of the oil and pressure limits of the system.

Because so many variables enter into the replacement method of increasing capacity it has been omitted from this study.

Several factors affecting the choice as to which method to use in increasing system capacity have been fixed: The sizes of lines were limited to 8-, 10- and 12-inch since these are common sizes dealt with by these methods; oil characteristics were fixed at 70 S.U.S. viscosity and 40 degrees API gravity; peak line pressures were limited to 1000 pounds per square inch.

THIS METHOD can be used by engineers to arrive at rapid economic comparisons when calculating oil pipe line system capacity increases, by means of looping existing lines or installing additional booster stations.

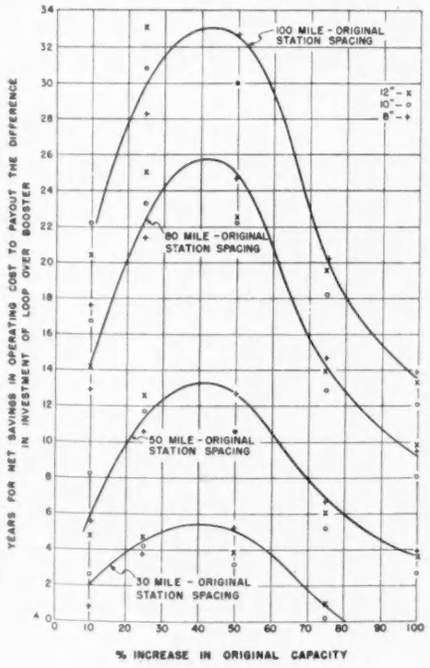

100 MILE - ORIGINAL STATION SPACING
80 MILE - ORIGINAL STATION SPACING
50 MILE - ORIGINAL STATION SPACING
30 MILE - ORIGINAL STATION SPACING
12" - X
10" - o
8" - +
YEARS FOR NET SAVINGS IN OPERATING COST TO PAYOUT THE DIFFERENCE IN INVESTMENT OF LOOP OVER BOOSTER
% INCREASE IN ORIGINAL CAPACITY

FIGURE 1.

Spacings Investigated

The resulting graphs show line sizes with station spacing and amount of increase as variables. The station spacings investigated were 30, 50, 80 and 100 miles. The amount of increase was established as a percentage of the original delivery capacity.

Other basic assumptions:

1. New pipe cost was used for the loop investment.
2. Diesel operation was assumed.
3. Permanent type, metal-clad buildings were to be installed at stations.
4. One spare pumping unit was available at all times.
5. Booster stations were manually operated with as small a complement as feasible.
6. Capacity increases up to 100 percent only.

The first standard established was that the net savings in operating cost will pay out the difference in investment of the loops over the booster. Payouts were plotted against the percent increase in original capacity. It was found that payouts for the three sizes were grouped generally together for various station spacings; hence, a mean line curve could be drawn at each station spacing for the three sizes investigated. As an interpretation of these curves, shown in Figure 1, the higher on the graph a particular situation falls, the more a booster station is favored, since the years required for savings by loops to pay out the additional investment becomes greater.

These curves show a similar shape for all station spacings, with a maximum point falling between 40 and 45 percent. This is the point where the booster station has the greatest advantage over the loop. It is produced by two factors. A single intermediate

About the Author

NICHOLAS B. MAVRIS majored in mechanical engineering at Oklahoma A. and M. College, Stillwater, and received a B.S. degree in 1948 and an M.S. degree the following year. He was an instructor in civil engineering at the college and in 1949 joined Interstate Oil Pipe Line Company as junior engineer. The following year he was loaned to Interprovincial Pipe Line Company at Edmonton, Alberta, Canada. He is now senior office engineer with Continental Pipe Line Company at Ponca City, Okla. Mavris was with the armed services for three years during the war.

station operating at full pressure will produce a 50 percent increase in throughput. Above this percent increase Point 2 intermediate stations must be used; also, as shown by Figure 2, plotting percent of original line looped versus percent capacity increase, the percentage increase in capacity for a unit length of loop increases above the 40 percent point. This means that the investment for each percent increase for the loop is smaller above the 40 percent mark than below it; thus, after 40 percent of the line has been looped, each mile of loop gives an increasing amount of capacity increase.

The next set of curves (Figure 3) were plotted for each station spacing investigated to show the total investment, the payout of loops over boosters, and the gross savings of loops over boosters. All are plotted against the percent increase in original capacity.

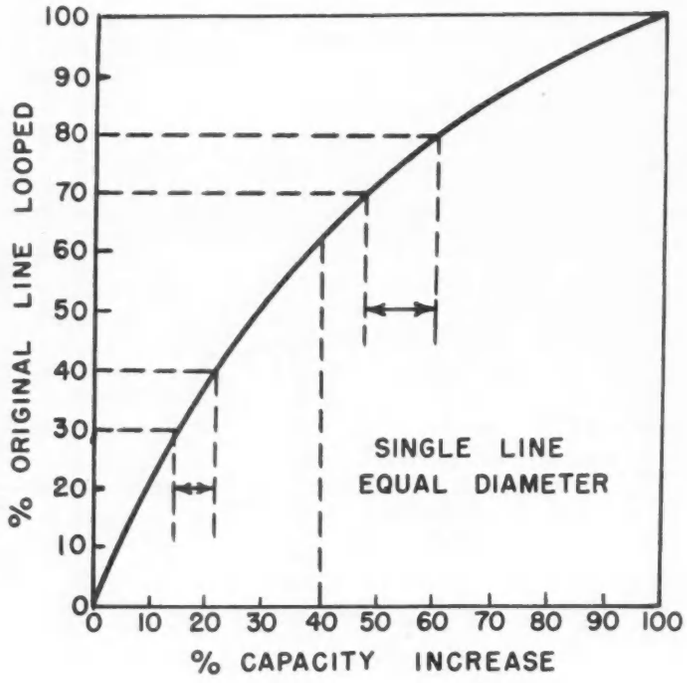
The next development was to establish tariffs which would be representative of the length of haul involved and to plot the payouts in years for each method, loops and boosters, for all percents of increase. Again, these were plotted for each length of station spacing. These curves for the 50-mile station spacing are shown in Figure 4.

By study of the curves, it develops that if it is imperative that an increase be transported, then Figure 1 alone would guide the choice between a loop and a booster for a long-time operation. For example, if a system which had 50-mile station spacing required 30 percent increase. Figure 1 shows that it would take 12½ years for the savings from using a loop to pay out the additional investment required for that loop. If this is judged a reasonable length of time, then a loop is indicated.

If the moving of the oil were not mandatory, the following procedure would be used: Using the tariff expected, the payout of each method can be determined from Figure 4. If these payouts are within a favorable range, Figure 1 should then be used to determine which method is the better.

Conclusions can be drawn as follows: From Figure 1, for systems with station spacings less than 50 miles, loops should always be used. Above 50 miles station spacing, the division would be the 50 percent capacity increase point. Up to 50 percent a booster is favored, but above 50 percent a loop is indicated. These conclusions are based on Figure 1 but are substantiated by the payout curves using tariffs such as Figure 4. The payout curves on the loops continue to decrease up to the 100 percent point, while the booster payout curves reach a minimum payout at the 45 percent point.

FIGURE 2.



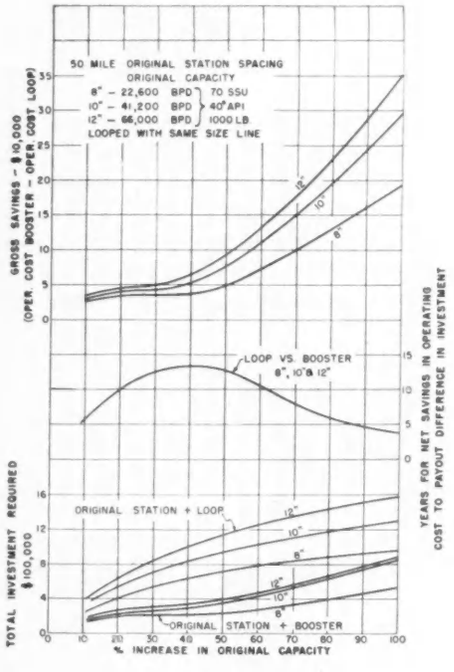

50 MILE ORIGINAL STATION SPACING
ORIGINAL CAPACITY
8" – 22,600 BPD } 70 SSU
10" – 41,200 BPD } 40° API
12" – 66,000 BPD } 1000 LB.
LOOPED WITH SAME SIZE LINE
GROSS SAVINGS – $10,000
(OPER. COST BOOSTER – OPER. COST LOOP)
LOOP VS. BOOSTER
8", 10" & 12"
YEARS FOR NET SAVINGS IN OPERATING
COST TO PAYOUT DIFFERENCE IN INVESTMENT
TOTAL INVESTMENT REQUIRED
$100,000
ORIGINAL STATION + LOOP
ORIGINAL STATION + BOOSTER
% INCREASE IN ORIGINAL CAPACITY

FIGURE 3.

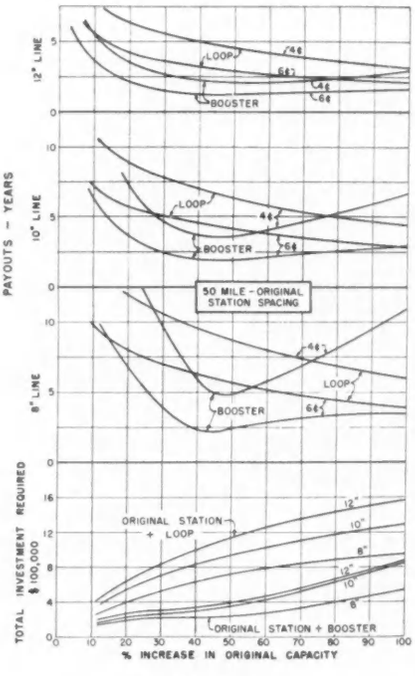
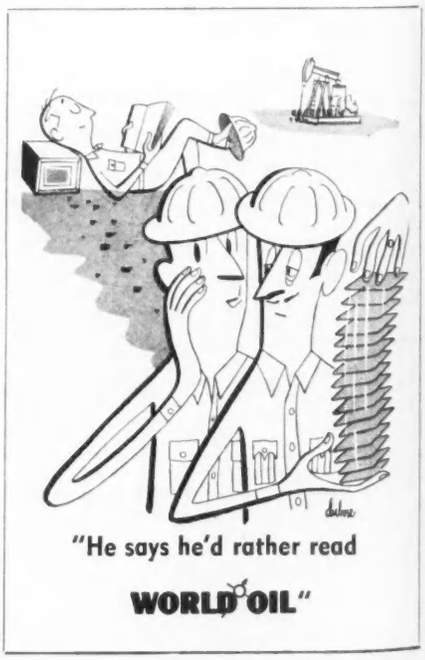


FIGURE 4.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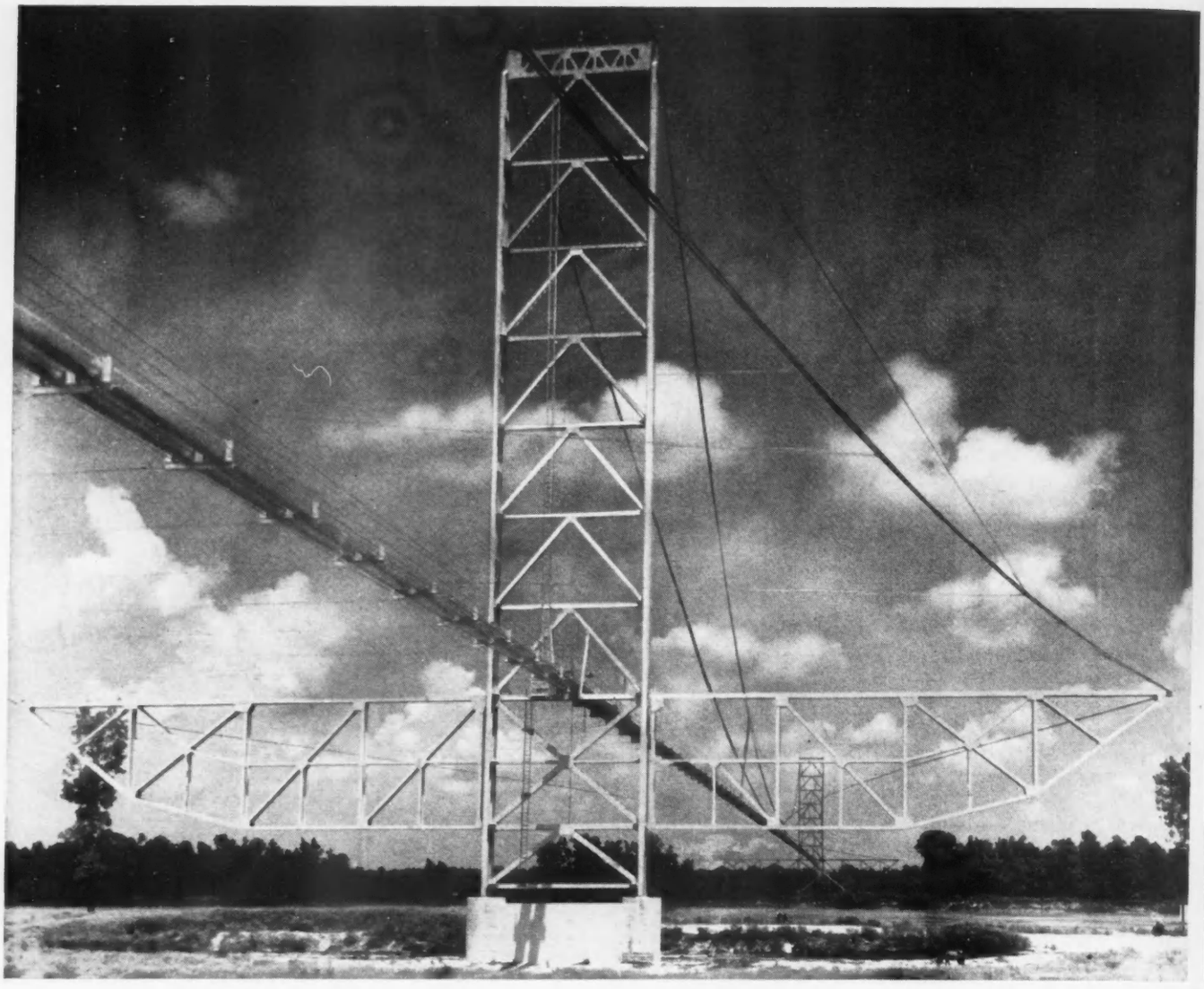


The two main towers rise 268 feet above the water, while the piers supporting the towers sink 165 feet below the surface of the ground. The horizontal wind truss near the base of the tower is 300 feet wide.

Longest Aerial Pipe Line Span Is

Structural Monument to Engineering Skill

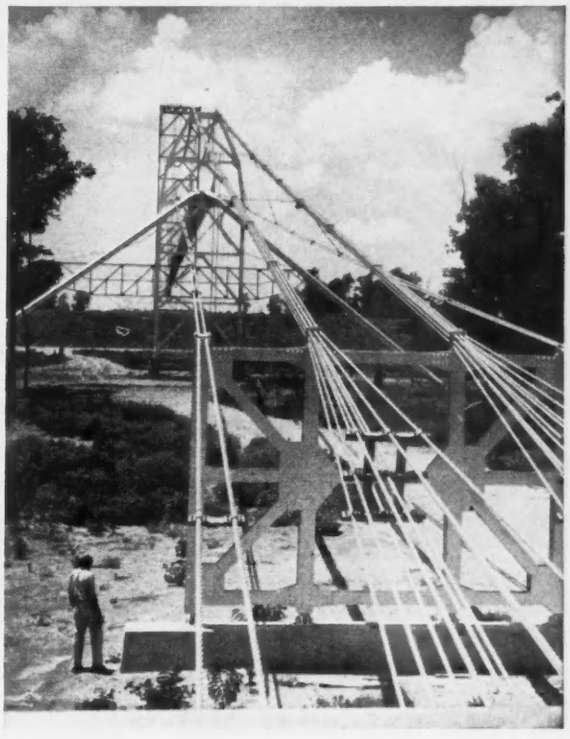
TOWERING over the turbulent Atchafalaya river at Melville, La., is the world's longest pipe line suspension bridge, a striking structural monument to engineering skill.

A key length in Transcontinental Gas Pipe Line Company's Gulf Coast-to-New York system, the bridge supports twin 30-inch gas pipe lines high above the boiling currents of the deepest river ever crossed by pipe lines.

Two great towers stand 268 feet high and 2000 feet apart on either side of the river. On each tower a horizontal wind truss 300 feet long resembles a giant wing-shaped cross-arm made of steel.

Two suspension cables sweep across the water in a graceful catenary curve to join the towers at the top. These cables support the pipe lines. Two wind cables traverse the long span at about the same elevation as the pipe lines, curving outward from mid-span to the ends of the wind trusses at the towers. These cables

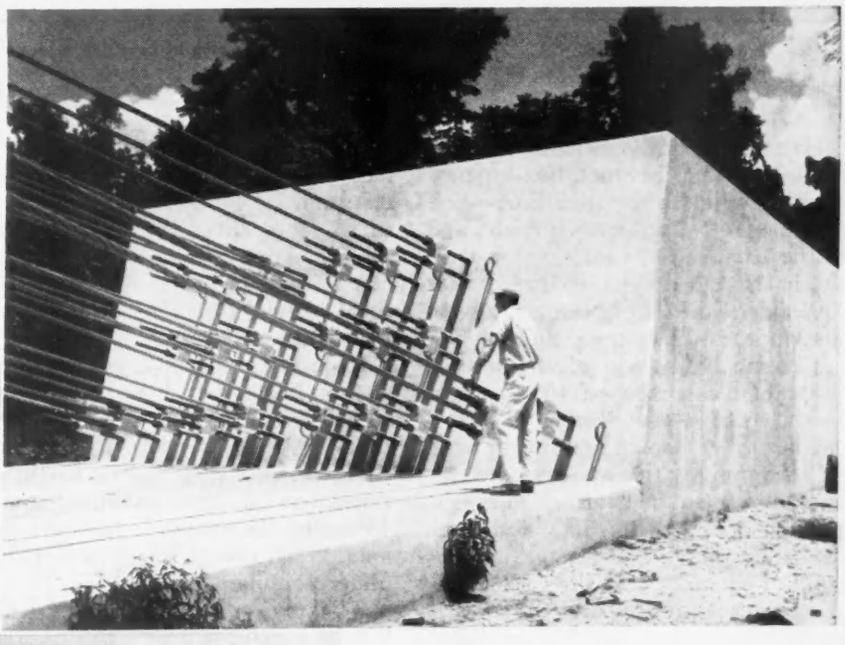
A MAGNIFICENT engineering feat of rare beauty is this longest pipe line bridge in the world. Built for Transcontinental Gas Pipe Line Company, the bridge was designed to support twin 30-inch gas pipe lines. One of the lines, now in service, can easily handle more than ½ billion cubic feet of gas with minimum pressure drop. The second line was added to take care of anticipated expansion.

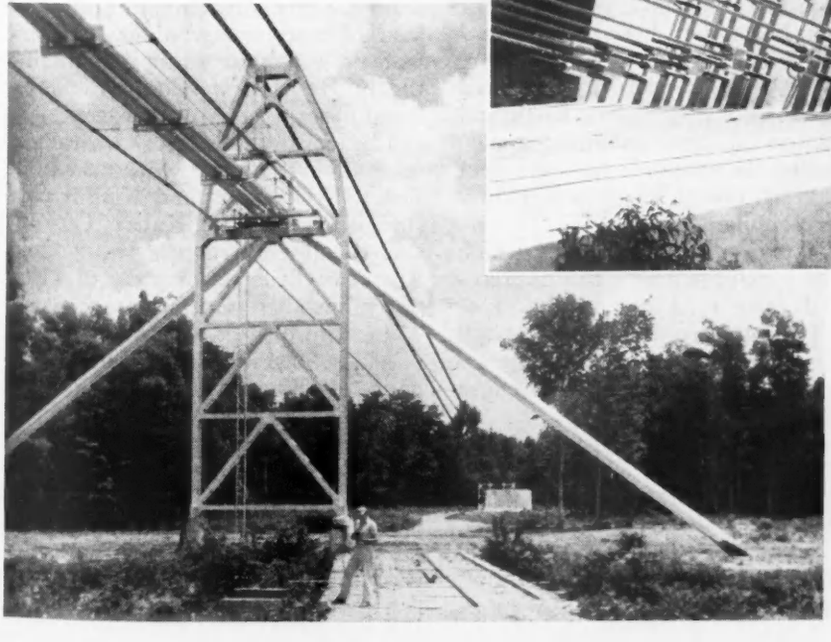


LEFT. The two main towers which support the central water span are 2000 feet apart.

RIGHT. A view from the east anchorage. Nine 1¾-inch pre-stressed galvanized bridge ropes are clamped together to form the main supporting cables. Two 2⅜-inch cables form each of the wind cables. The tower in the foreground is called the "rocker bent," because of hinges at the base.

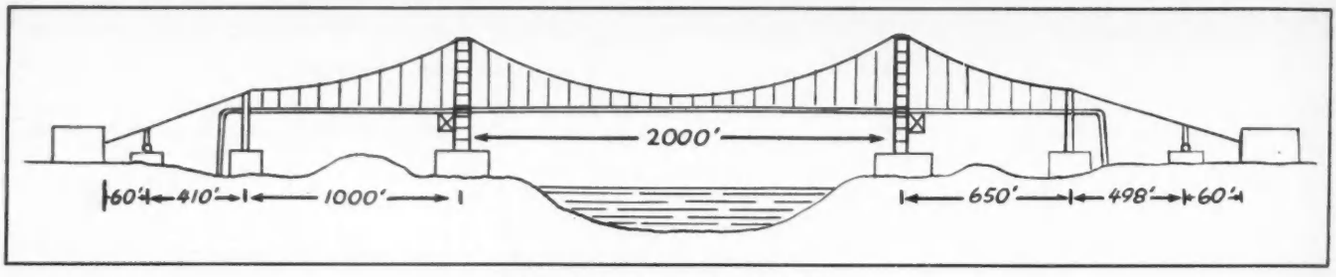
The east anchorage which resists constant tug of cables, contains more than 2000 cubic yards of reinforced concrete and rests deep underground on 67 14-inch pilings 115 feet long.





Pipe line risers join the bridge at the 100-foot rest towers.

Full length view of the 4678-foot bridge which lifts two 30-inch natural gas pipe lines high above the Atchafalaya River near Melville, La.



Schematic drawing of pipe line bridge.

prevent lateral movement of the pipe lines. Hundreds of small box-type assemblies support the pipe lines—tied to the overhead suspension cables and to the lateral wind cables with a multitude of five-eighths-inch diameter suspender cables which impart a web-like appearance to the structure.

On the bank side of the towers, the cables converge on 100-foot rest towers, and then stretch to yet a smaller tower known as a rocker bent. (The latter tower was so named because hinges at the bearing plates permit the bent to rock back and forth as expansion or contraction of the cables take place.) At the rocker bent the cables splay into individual wire ropes and tie to steel in the anchorage.

Over-all length of the bridge between anchorages is 4678 feet. For 3650 feet of this distance, the structure supports two 30-inch, .375 wall pipe lines which weight 118.4 pounds per foot each—a total weight of 875,000 pounds.

Because of the unusually long spans and the heavy load, great strength was designed into the bridge. For example, the solid reinforced concrete piers supporting the main towers are 29 feet wide, 60 feet long, and 189.5 feet high. Of the height, 165.6 feet rests underground to counteract overturning moments due to lashing winds, snow and ice. Strength of the towers can be judged by the upright structural beams, the webs of which are more than six feet wide.

Each of the massive anchorages or anchor blocks which resists the constant tug of the cables contains more than 2000 cubic yards of reinforced concrete sunk deep in the earth and resting on top of 67 lengths of piling, 14 inches in diameter and 115 feet long. Weight of each anchor is slightly under 1 million pounds.

The two suspension cables which lift the pipe lines across this unprecedented river span are made up of nine 1¾-inch pre-stressed galvanized bridge ropes, clamped together to give each cable an ultimate strength of 2,574,000 pounds.

Because winds of hurricane velocity can always be expected on the Gulf Coast, the long central span offered a definite problem in windbracing. Oscillating movement of wide amplitude could quickly destroy the bridge. Matthews and Kenan of San Antonio, Texas, designers of the bridge, solved the problem by using wind cables with ultimate strength of 1,044,000 pounds and stretching them to violin string tautness. Other considerations entering into design were ice loads which could possibly cover all surfaces of pipe, walkways and cables, adding tremendous weight; the live load of workmen who may concentrate in one spot when maintaining the bridge; and weight of the pressured natural gas inside the pipe.

The construction work consumed more than 18 months. Massman Construction Company and Kansas City Bridge Company of Kansas City installed all substructure work, and American Bridge Company of Pittsburgh installed superstructure work. The entire project was under the supervision of Fish Engineering Company of Houston, Transcontinental Gas Pipe Line Company's representative on this job.

Today only one of the lines is in service, easily handling more than ½ billion cubic feet of gas with minimum pressure drop. The second line was added to take care of system expansion expected in a few years.

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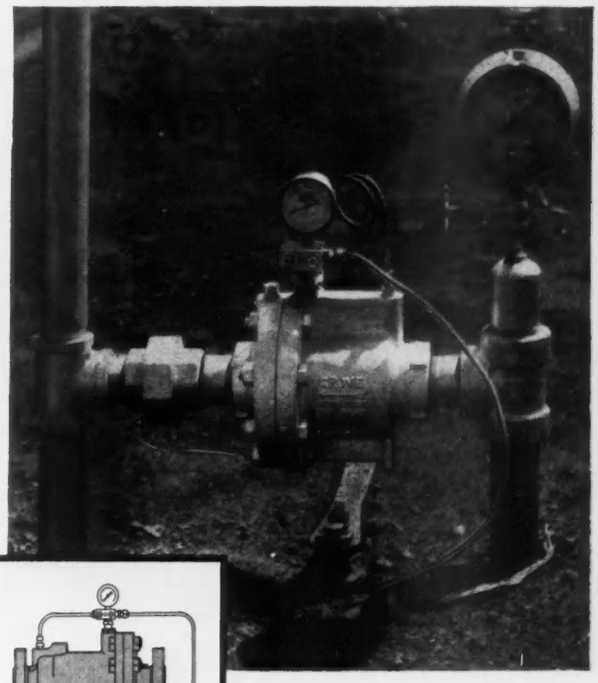
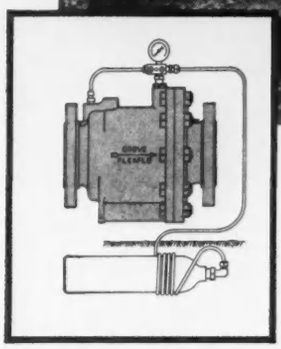
Expansible tube type regulators are more reliable — need less attention

Dependability is the main requirement in oil field regulator installations where constant inspection and maintenance are impractical. Stemless, springless Flexflos have no metallic moving parts to corrode, stick, or wedge. No stuffing boxes to leak or freeze. Flexflos cannot fail to close perfectly with bubble-tight shut-off despite foreign particles or minor wear. Flexflos are instantly responsive to the slightest pressure variations. Action is smooth and rolling with no damaging slam or chatter.

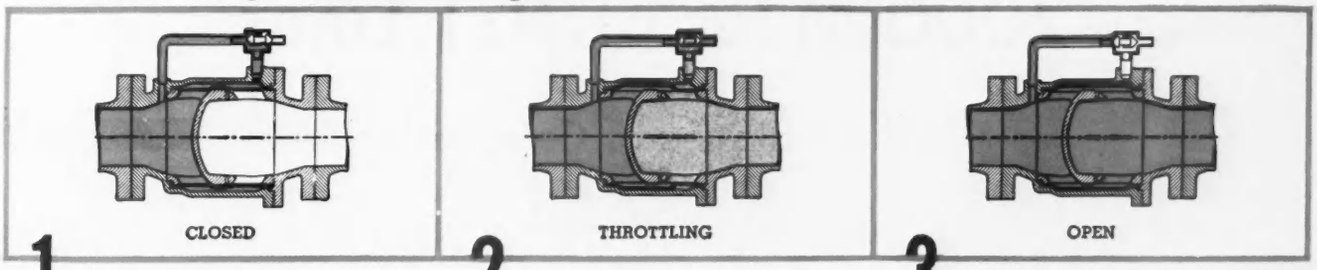
All these important features add up to reliability. Maintenance-free performance you can count on day in, day out. Longer life under the most punishing field conditions. See below how Flexflo's simple operating principle can increase your regulator efficiency; reduce costly breakdowns and eliminate shop overhauls.





A Model 888 Grove Flexflo Reliever on Separator Gas Line. Pressure loaded operating cylinder is ground insulated against ambient temperature changes.

Here's why: *flexflo* lets pressure do the work--



CLOSED

THROTTLING

OPEN

1 The only moving part in the Flexflo Valve is a tough Buna N tube stretched over a cylindrical slotted metal core. When closed, line pressure from within, tending to force tube off core, is opposed by equal jacket pressure. Tension of the tube itself forms a positive, bubble-tight seal. The tube conforms to uneven surfaces and is hence unaffected by foreign matter or erosive wear.

2 As jacket pressure is reduced, line pressure begins to roll the tube off the core, opening the valve. Throttling is smooth and even. The Flexflo reacts instantly to the slightest pressure variations, compensating automatically for surge or shock impulses. Stability at all flow positions is accurately maintained. Fluttering and chattering are reduced to a minimum.

3 When all jacket pressure is removed, the tube is forced completely off the core and the valve assumes its wide open position. Full flow capacity with minimum pressure drop is assured. As Flexflo employs no hinge-pins, guides or other metallic moving parts, no troublesome problems of corrosion or wear are encountered. It cannot stick, wedge or slam.

GROVE

Grove Flexflo Valves and Regulators are adaptable to air, gas, oil, water and other fluids at temperatures to 150° F. Available in iron or steel, sizes 1" to 12", for working pressures up to 1500 psi. Wire or write for full details.

flexflo VALVES and REGULATORS

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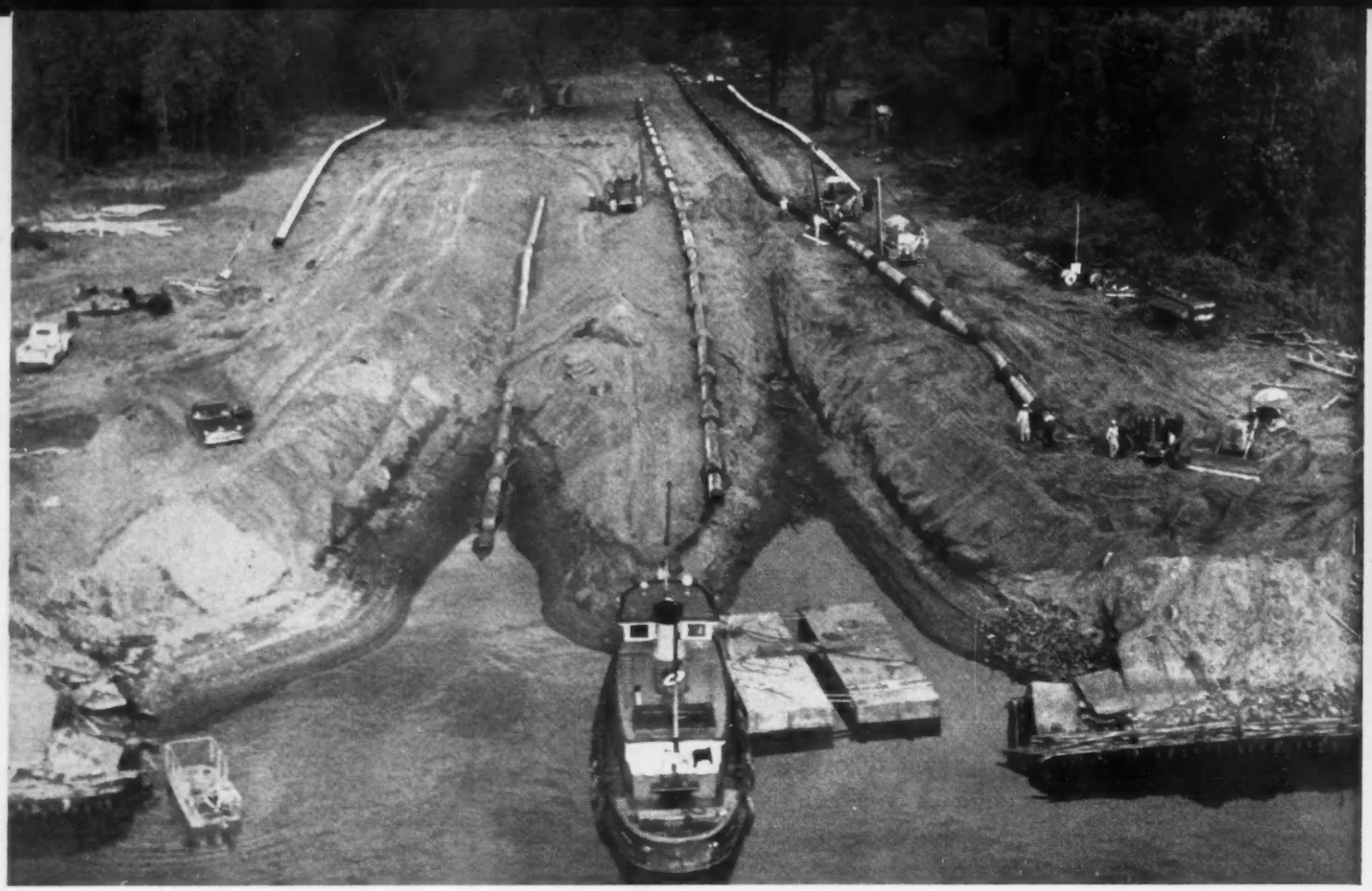
1901 CALUMET, HOUSTON 4, TEXAS • 205 EAST 69TH ST., NEW YORK 21, N. Y.

DISTRICT OFFICES: Dallas, Corpus Christi, Odessa, Texas — Lafayette, Louisiana — Tulsa, Oklahoma — Los Angeles, California 9101



Britton and Clark Construction Company installed twin 24-inch Hudson River crossings near Albany, N. Y. The two lines were spaced 50 feet apart and constructed simultaneously. The lines were submerged ten feet in rock and 20 feet in soil at a minimum elevation of 41 feet below mean water level. Pipe is half-inch wall with 5500-pound cast iron weights on 25-foot centers.

2000 Miles of TGT Lines

In Final Stages of Completion

TENNESSEE Gas Transmission Company of Houston is in the final stages of an extensive 1951 construction program.

The 303-mile, 24-inch extension of the company's main system across New York state brought its system length to more than 2000 miles, longest in the nation. The extension was completed about August 1.

The New York Line and 541 miles of loop line—all but 24 miles of it 30-inch—increased the system capacity from approximately 1 billion cubic feet daily to 1,200,000,000 cubic feet and raised total pipe line mileage in service to more than 5100. The 24 miles of 26-inch was laid in South Texas, and the 30-inch in Texas, Louisiana, Mississippi, Tennessee and Kentucky, parallel to the company's existing system. The loop line is approximately 99 percent complete.

A compressor station enlargement and building program has been pushed ahead. Three new stations, two in Ohio at Cambridge and Albany and one at Hamburg, N. Y., have been built and are ready to be added to the line. A fourth near Carrollton, Ohio, recently was begun and will be finished this winter if weather permits, and seven of the 17 stations Tennessee Gas already had in service have been enlarged. The three stations and enlargements have increased compressor horsepower by 54,500, raising the system total to 380,000, and the fourth being constructed will add 7920 more horsepower for a 387,920 total.

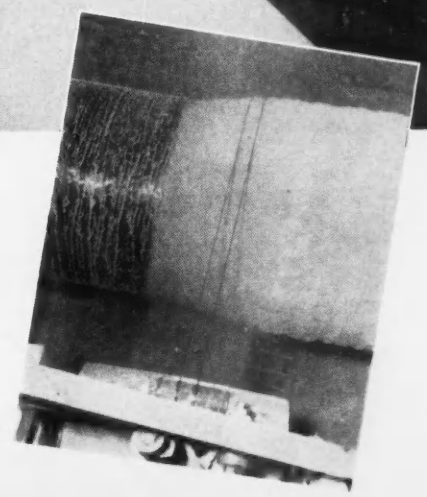
TENNESSEE GAS Transmission Company has continued its steady pace-setting growth in 1951, extending its system length to 2000 miles, increasing daily delivery capacity to 1.2 billion cubic feet, and raising its total length of pipe line in service to 5100 miles. A portion of the system now has four parallel lines through which gas travels at speeds of 17 to 20 miles per hour.

The new capacity has been added to care for expanded markets along the present system and to furnish a supply to Northeastern Gas Transmission Company, Tennessee Gas subsidiary, for sale to distributing companies in New England. The parent company's New York extension

Whether your problem is corrosion that requires coating and wrapping or weighting pipe through water, swamps, or rivers, ROSSON-RICHARDS has the experience and know-how to complete the job right. ROSSON-RICHARD Companies, with their years of practical experience, are ready to move in and do the work right on your spread.

Two Pipeline Problems Solved by ROSSON-RICHARDS

ROSSON-RICHARDS plants are prepared to give you the finest pipe coating and wrapping service available. In the plant or on the job their facilities provide fast and dependable service to rapidly moving pipeline operations.



If pipe is to be laid in water where weighting is important, WATE-KOTE is the answer. WATE-KOTE, developed by ROSSON-RICHARDS, is a pipe-coating material of unusual high density and strength which provides the maximum weight and protection. It is rapidly replacing the use of heavy-wall pipe and cast iron and concrete river clamps and is far superior to the ordinary concrete coating. The high specific gravity of the aggregate which is used instead of sand and gravel, and the method of its application to the pipe are the secrets of WATE-KOTE's high efficiency.

ROSSON-RICHARDS COMPANY
ROSSON-RICHARDS PROCESSING CO.
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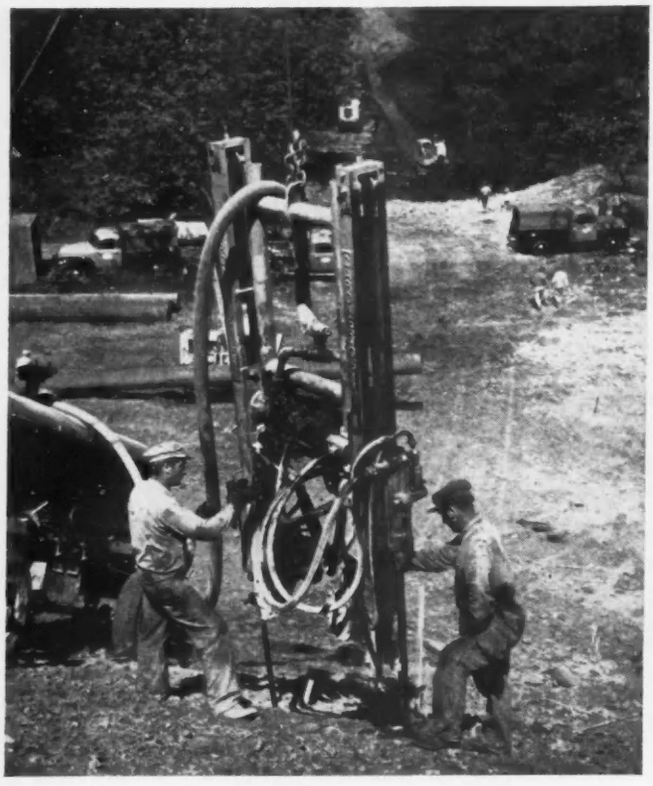
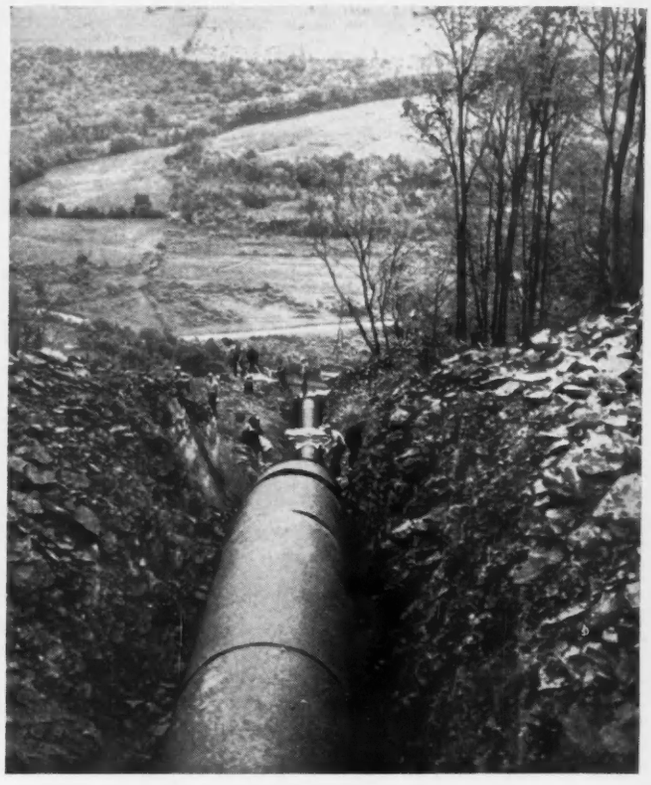


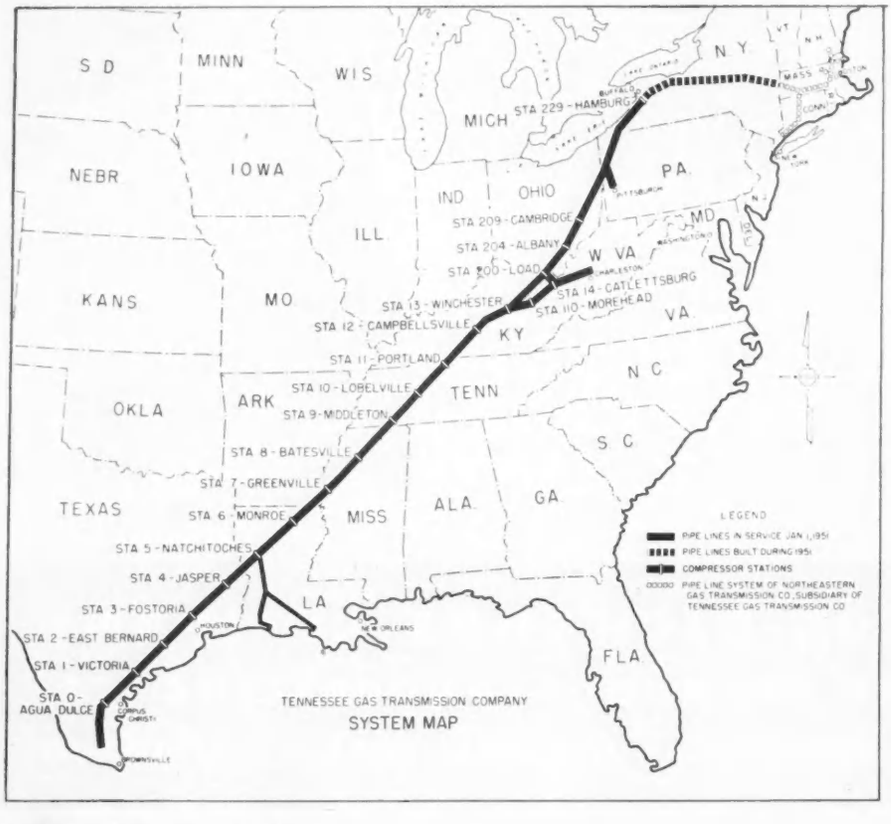
Pneumatic "wagon drills" were used to drill shot holes for blasting a ditch through rock when laying a section of the line through New York. This innovation was developed by TGT engineers.



H. C. Price Company workmen fill sacks for breakers used to hold section of 24-inch line lowered in on steep Bull Hill near Auburn, N. Y. Slope averaged nearly 60 degrees for almost 1200 feet.

connects at the New York-Massachusetts border with that of Northeastern Gas.

Early in 1951 Tennessee Gas became the first company to obtain part of its gas supply from the open, unprotected waters of the Gulf of Mexico. The gas originates from wells drilled by The Pure Oil Company from a drilling platform in water about 50 feet deep at the Rollover field southeast of Lake Charles, La., and moves through the ten-mile, 8⅝-inch pipe line of the Marine Gathering Company into the Tennessee Gas gathering system at a connection on shore. Gas previously had been obtained from the tidelands through pipe lines laid across lakes and protected bays, but this was the first from the open Gulf.



In order to obtain this and other supplies of gas, the company sometime ago extended its Louisiana gathering system into South Louisiana.

Entering the petro-chemical field, Tennessee Gas this fall began limited-scale operation of a new $10 million liquefiable hydrocarbons plant near Gabe, Ky. The plant, expected to be in substantially full operation shortly, has a rated capacity of processing 750 million cubic feet per day of the natural gas stream which passes through the company system there. Production capacity is about 380,000 gallons daily of hydrocarbons, which include about 16 percent of the ethane from the gas stream and substantially all the propane, butanes, hexanes and heavier hydrocarbons present.

The plant's output is being transported through a 58-mile pipe line and sold to the new Doe Run plant of the Mathieson Hydrocarbon Chemical Corporation 35 miles from Louisville.

The Mathieson plant's production

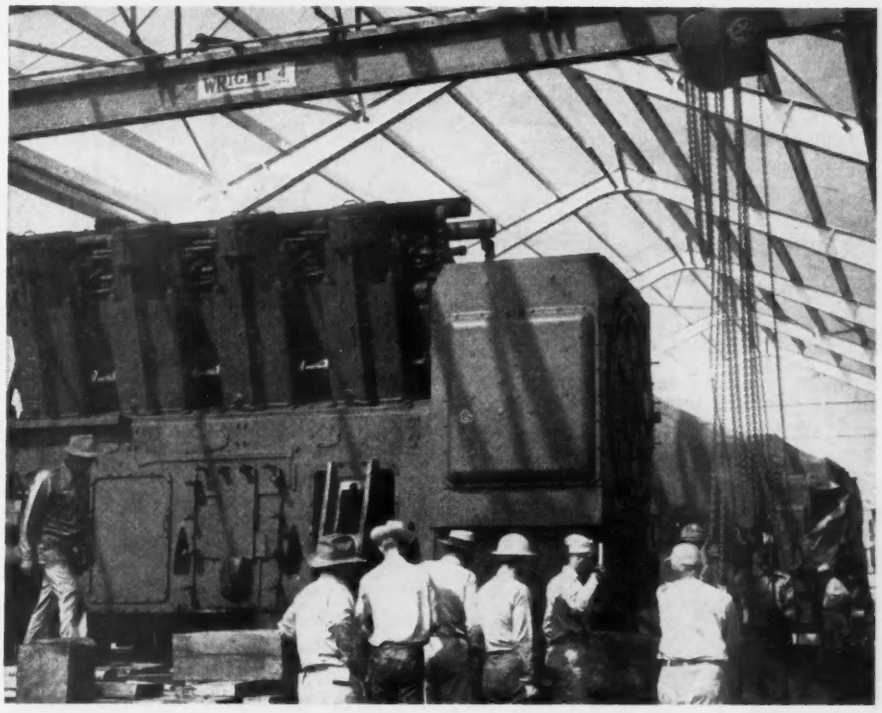
will include ethylene glycol and other chemicals which are in brisk demand. When in full operation the plant is expected to produce about 10 percent of the total U.S. supply of ethylene glycol.

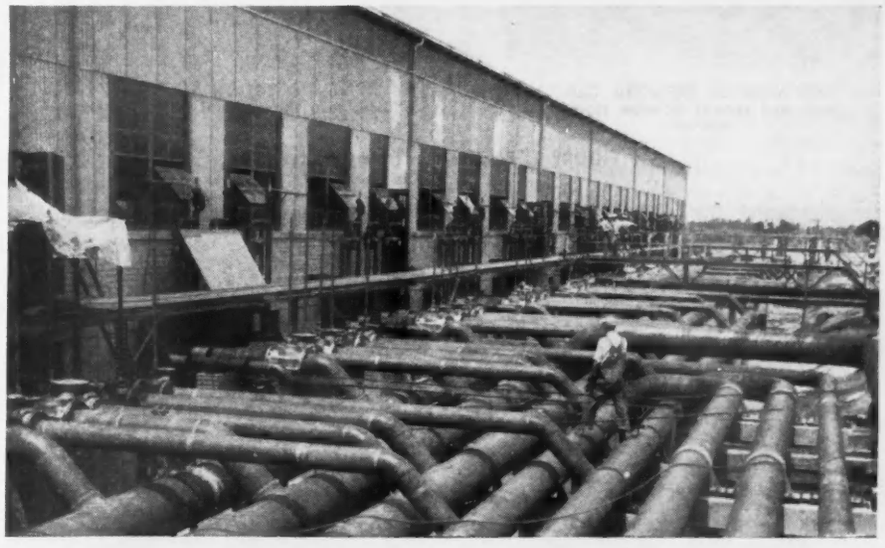
This fall the company began first delivery of natural gas to New England in that area's history. Tennessee Gas furnished gas at the New York-Massachusetts state line near Pittsfield, Mass., to its subsidiary, the Northeastern Gas Transmission Company. Northeastern, in turn, began deliveries to various distributing companies in New England.

Brief History

The brief history of Tennessee Gas is a story of continual building for tomorrow. It was on December 4, 1943, at the height of America's drive to win World War II, that the firm began constructing its original natural gas pipe line from South Texas to West Virginia. This single 24-inch line, completed as part of the war effort in a record-breaking 11 months, was the nucleus of a system that has grown into one of the nation's leading natural gas carriers.

The system stretches from near the U. S.-Mexican border in the Rio Grande Valley to near the U.S.-Canada border in western New York, thence eastward across New York to the Massachusetts line. For most of that distance, the system consists of three parallel main lines of 24- to 31-inch pipe carrying approximately, 1-, 200,000,000 cubic feet of natural gas daily. The gas is sold at wholesale, principally to other pipe line systems, in the ten states crossed: Texas, Louisiana, Arkansas, Mississippi, Tennessee, Kentucky, West Virginia, Ohio, Pennsylvania and New York.



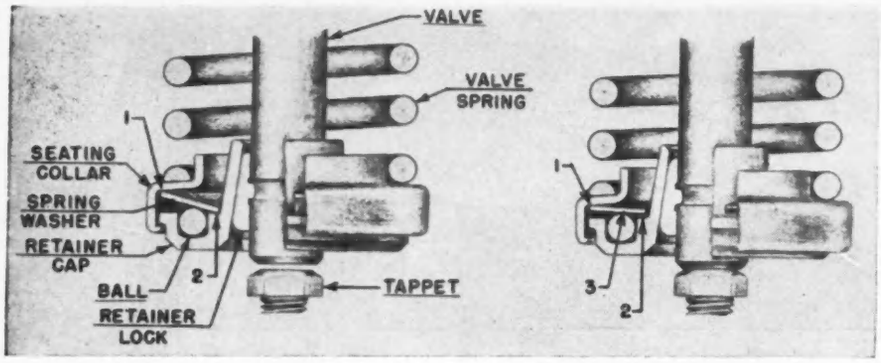


☆

TOP. Installing 2000-horsepower compressor engine at TGT station No. 1, Victoria, Texas. Total system horsepower will soon reach 387,920.

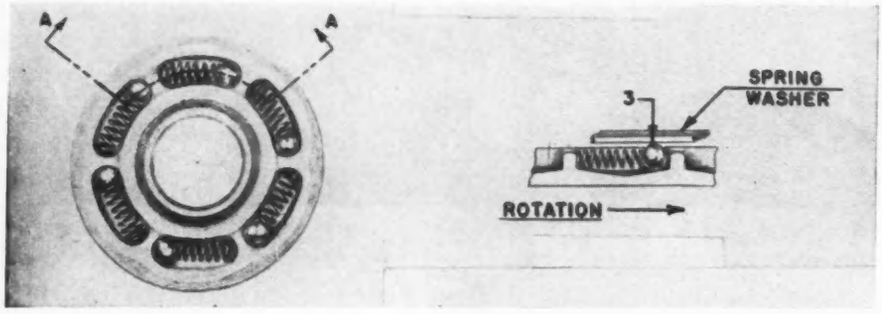
CENTER. Compressor building is operated in conjunction with TGT's hydrocarbon recovery plant at Gabe, Ky.

BOTTOM. "Jeeping" TGT's 30-inch pipe line for holidays in coating.



VALVE CLOSED
Load at (1) and (2).

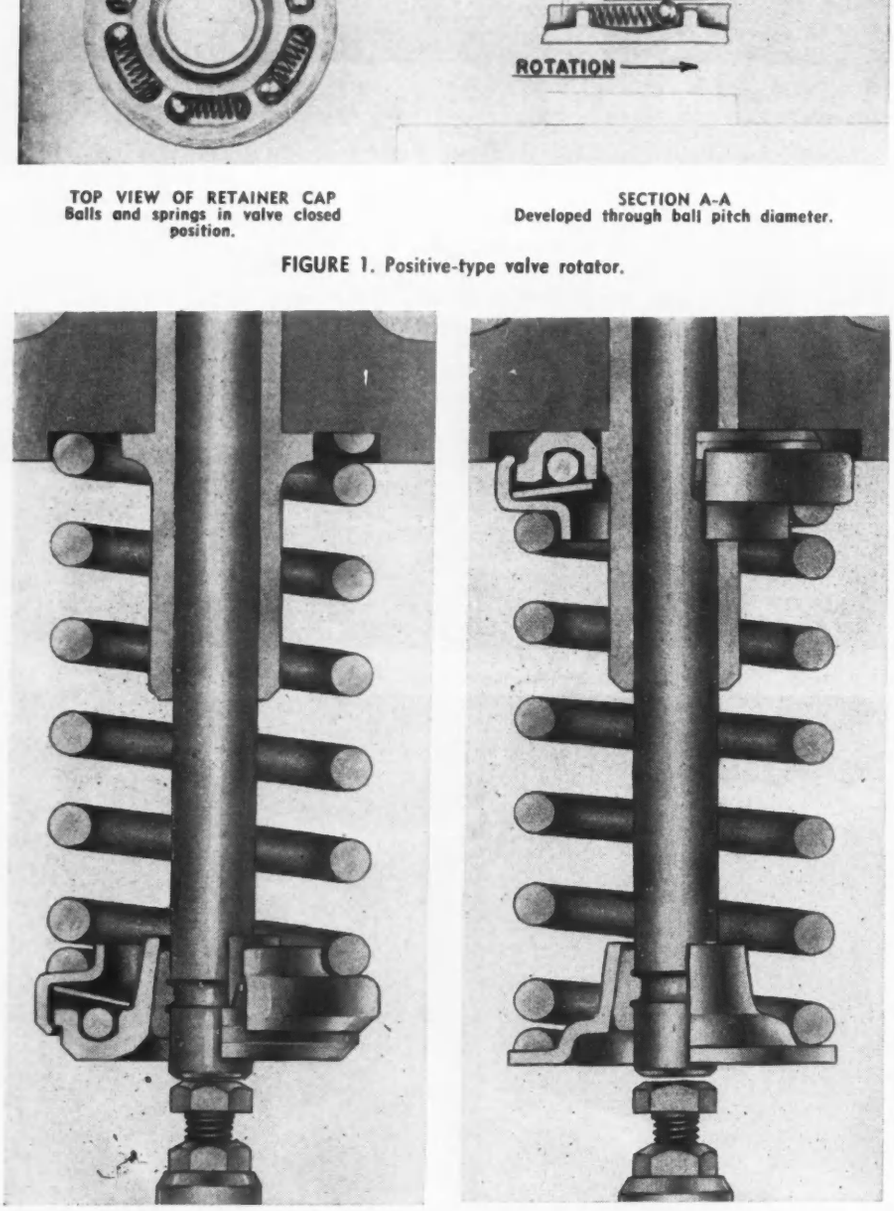
VALVE OPEN
Increase of valve spring pressure deflects spring washer transferring load from (2) to (3) causing ball to roll down incline shown in Section A-A.



TOP VIEW OF RETAINER CAP
Balls and springs in valve closed position.

SECTION A-A
Developed through ball pitch diameter.

FIGURE 1. Positive-type valve rotator.



(Valve tip end installation)

(Guide end of spring installation.)

FIGURE 2. Positive type valve rotator.

Mechanical

A MECHANICAL means of producing controlled engine valve rotation during operation greatly prolongs valve life. Since satisfactory engine performance depends on reliable operation of the engine valves, this is a great stride in engine development.

In a previous article[1] a general statement was made that 90 percent of all valve engine failures are caused by sticking or burning, and some of the conditions which contribute to such failures were cited. As a corollary to this statement it may be said that the deposition problem is the biggest barrier in the path of the valve engineer. Sticking and gumming of valve stems and flaking of face deposits all preclude good valve seating and lead to hotter valves. These problems have been largely overcome by metallurgical solutions. The quality of the valve steel was made sufficiently good to withstand operation under some degree of deposition. While remarkable advances in valve performance have been made by this metallurgical approach, it is becoming increasingly difficult to produce new alloys which will withstand the mechanical and thermal stresses imposed by present-day engines. For this reason, some mechanical means of coping with valve deposition has become necessary.

Such a means, and one which is proving extremely effective in extending valve engine service, is that of rotating the valves while the engine is in operation. Valve rotation has proved extremely effective in overcoming the deposition problem. By rotating the valve, the stem and guide are kept free of deposits, preventing sticking, a common cause of valve burning. Furthermore, rotation imparts a wiping action between the valve face and valve seat which prevents the buildup of deposits which could flake off and allow blowby. Again, valve rotation will avoid prolonged exposure of any one sector of the valve face to a local hot spot on the seat. This, in turn, will result in

Rotators Prolong Valve Life

By A. L. POMEROY

Director of Development, Thompson Products, Inc., Cleveland

ENGINE VALVES operate in hot, corrosive gases which take heavy toll in valve life span. Despite recent advances in metallurgy, burning has caused most valve failures. Recently a mechanical device which turns the valve as it operates has proved able to reduce burning and sticking.

lower and more uniform valve face-seat operating temperatures.

The potentialities of valve rotation were recognized as far back as 1938 when a valve rotator based on the release-type principle was developed. However, this type of valve rotator was found to be relatively costly to manufacture because of the close tolerances of the component parts.

In view of the foregoing considerations a new, positive-type valve rotator recently was developed which can be produced at relatively low cost and requires no servicing. This unit is a device which in itself, independent of the engine and valve train vibrations or frequencies, provides positive, controlled valve rotation. The unit is self-contained, necessitating no special skill for installation and introducing no additional maintenance requirements.

This positive-type valve rotator is illustrated in Figure 1. It consists of a spring seating collar spun over a retainer cap, encompassing a Belleville washer, a set of balls in inclined races, and ball return springs. With the valve in the closed position, the washer is loaded at Point 1, with a reaction at 2. As the valve starts to open, the additional valve spring load flattens the washer, transferring the load from 2 to 3, causing the balls to roll down the inclined races. The reaction of the balls on the races causes the retainer to turn, and through the friction grip of the valve locks, the valve also rotates. As the valve closes, the balls are returned to their original positions by the return springs. The rotator is then set for the next valve cycle. The rotation can be made to take place with the valve off, or on, the seat as may be desired. The amount of rotation can be varied but is generally in the range of 6 to 8 degrees per valve cycle.

The positive-type valve rotator can be placed at either end of the valve spring (Figure 2). However, there are certain advantages to be gained by having it located at the valve tip end, namely, the saving of the cost of the spring collar it replaces, and the fact that it can be interchangeable with the standard spring collar, thus necessitating no physical changes to the valve. In cases where the rotator is thicker than the standard seating collar, the valve spring is changed to accommodate the additional thickness.

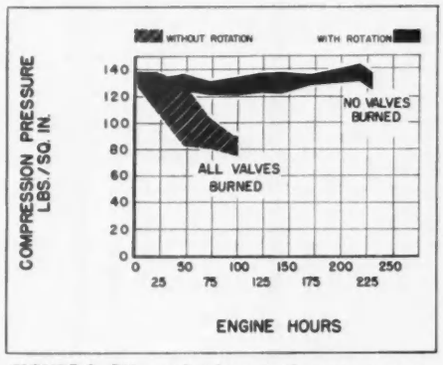


FIGURE 3. Effect of valve rotation on compression pressure.

Quantitative data on the performance of rotated valves, based on extensive laboratory and wide-scale field tests in a variety of equipment in all types of service, have conclusively confirmed the theoretical benefits of rotation and indicate that exhaust valve life has been improved from two to five times in practically every installation. Some graphic examples of these benefits are as follows:

The Petroleum Chemicals Division of E. I. du Pont de Nemours and Company recently completed the survey shown in Figure 3. The rate of valve deterioration, illustrated by compression pressure, for the non-rotated valves is quite rapid, leading to complete failure in a relatively short time. With rotation, no appreciable deterioration was evident and no failures occurred.

The appearance of rotated valves after many hundreds of hours of op-

Standard 40 Hours — Rotated 100 hours

FIGURE 4. Comparison of rotated and non-rotated valves.

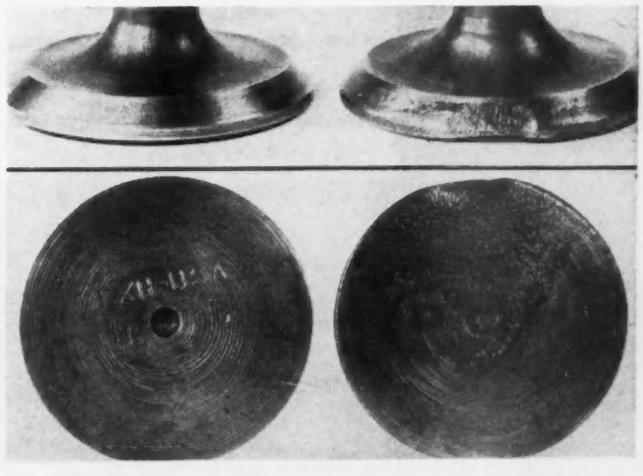


FIGURE 5. Comparison of rotated valve (left) and locally-burned non-rotated valve (right).

eration is often truly remarkable. Figure 4 contrasts rotated and non-rotated valve deposits. Flaking has caused failure of the non-rotated valve. The nature of the burned valve face is clearly apparent from Figure 5.

In Figure 6 it is significant to note the benefits imparted to stationary power plants by valve rotation which undoubtedly will have considerable interest for pipe line engineers. Stationary engines give considerably more trouble because of their constant speed and constant load operation. Such operation is particularly conducive to the formation of face deposits, thus making the application of rotators of particular value.

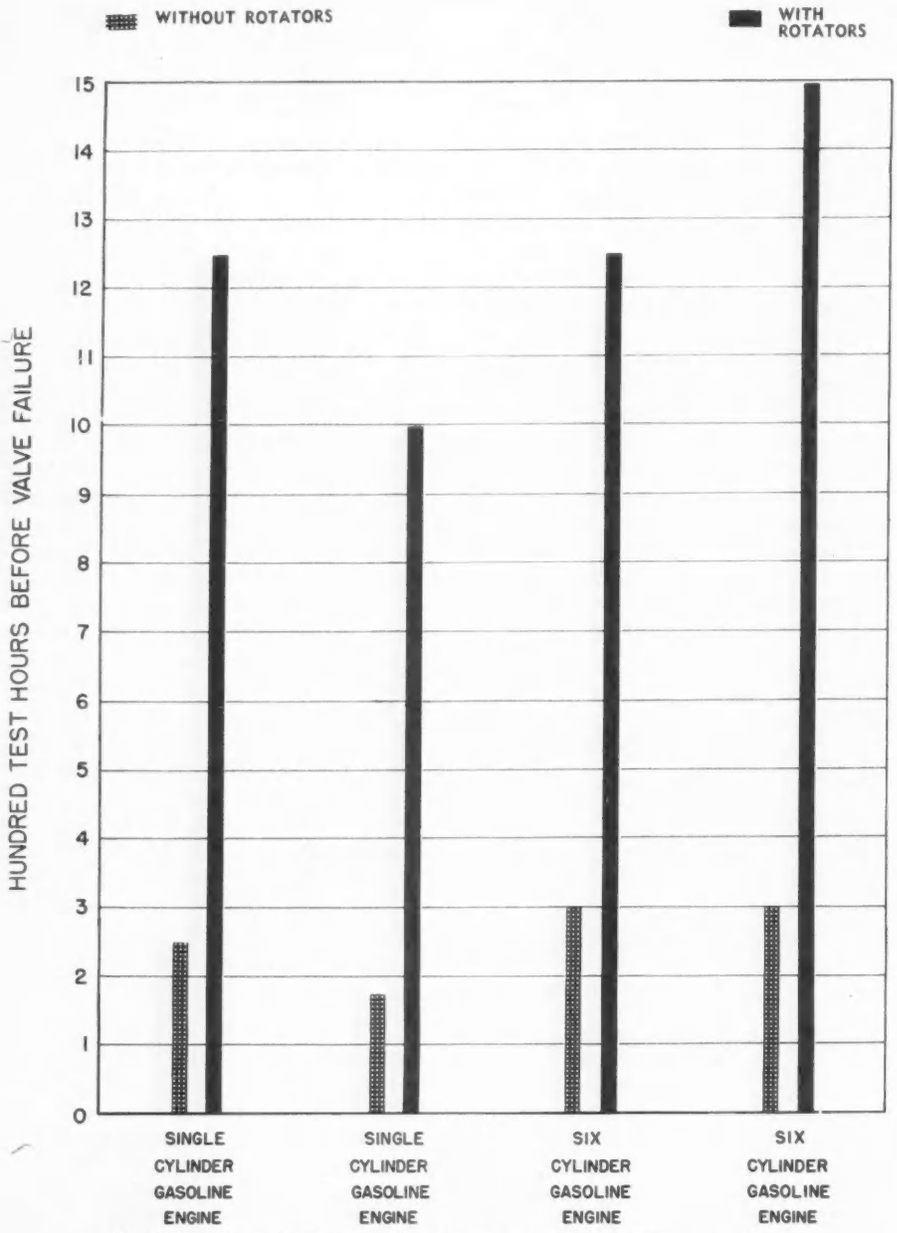


FIGURE 6. Chart showing benefits of valve rotation in stationary engines.

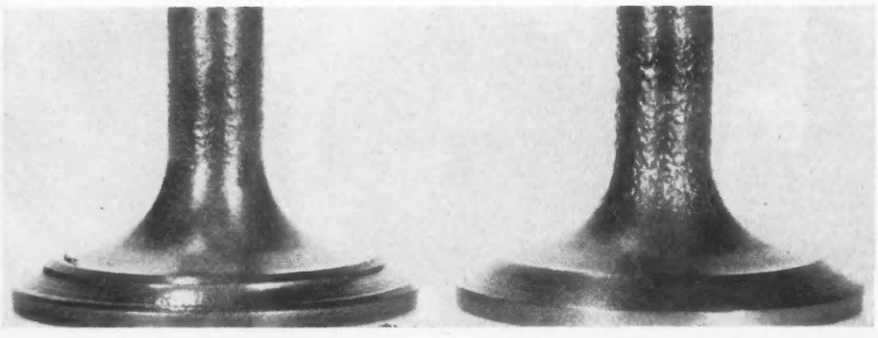


FIGURE 7. Valve face wear with inherent rotation.

Figure 7 shows a peculiar type of face grooving exhibited with inherent valve rotation. Valve face wear of this nature is caused by high inertia forces which cause excessive valve turning on the seat. In this instance, incipient surge of the valve spring led to the valve rotation resulting in tappet clearance loss. Losses in tappet clearance, unless frequently compensated for, hold the valve off the seat under high load operation which will lead to premature valve burning, thus, with face wear, the purpose of rotation is defeated.

The use of improved oils in engines is becoming more prevalent. The compounding of oils is analogous to the alloying of steels to fortify certain properties. However, the inclusion of additives in the engine oil has in some instances led to a valve deposition problem which materially reduced the life of the valve. Here again, rotation contributes greatly to solving this problem as it is effective in coping with the deposition on the valve face. Under controlled tests it was shown that improvement in valve life was considerably greater than that which was indicated in the loss resulting from the use of compounded oil, thus enabling the operator to realize the benefits of compounded oil without incurring any penalties in valve performance.

Rotation is not necessarily confined to exhaust valves. In equipment where intake valves are marginal because of sticking or face deposition, the rotator has been found to be equally effective (Figure 8). In some cases, this application may necessitate a change in the intake valve material to avoid valve face grooving if the steel is too soft.

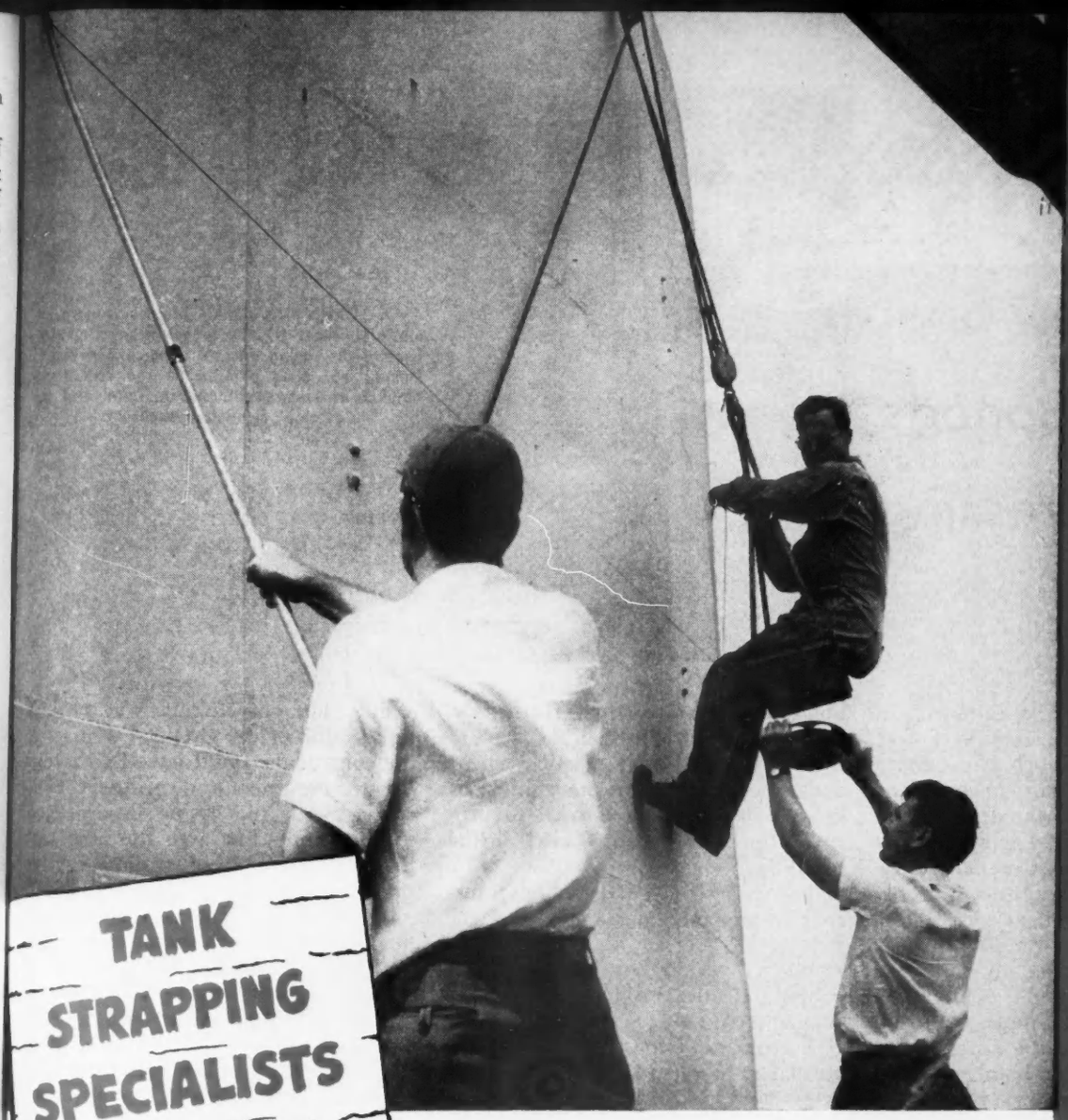
Other secondary benefits are obtained through valve rotation. It has been used to prevent valve stem scuffing, as it distributes what lubrication is present around the valve stem diameter and prevents the condition of metal-to-metal contact that is usually responsible for scuffing. Valve guide wear can be reduced by rotation. By rotating the valve, undue tip wear is prevented, eliminating the localized wear frequently found with non-rotated valves in overhead valve engines. Such wear is important because it interferes with proper lash adjustment.

REFERENCE

[1] Pomeroy, A. L., "Engine Valve Failures and Remedies" WORLD OIL, July, 1951, pp. 224-29.

ACKNOWLEDGMENT

This article was prepared for WORLD OIL from a paper, "Valve Rotation—Its Impact on Engine Design and Operation" delivered before the Mid-Continent Section, Society of Automotive Engineers, Oklahoma City.



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New Seal Speeds Road Crossing

1. A 24-inch wide blanket of special inorganic material is cut slightly longer than circumference of the casing. After a light coat of plastic cement has been painted on the casing the blanket is wrapped around the pipe and the overlap cemented together.

A NEW seal can be installed on any pipe line casing in a few minutes—even though the carrier pipe and casing are not concentric or the casing perfectly round.

Developed by Al Stegner, Tennessee Gas Transmission Company engineer, the new device offers relief to those pipeliners who have spent hours —or even days—wrestling bushing or other material into the annular space between a pipe line and a road casing.

The new seal is simple to install and requires no special tools or skilled labor. A 24-inch wide blanket of special inorganic material, slightly longer than the circumference of the road casing, is sealed to the pipe and casing by a light coat of plastic cement as shown in accompanying illustrations. Band clamps which further secure the blanket material in place are covered with special plastic cement and protective tape. A rock shield or heavy felt wrapping is used to protect the blanket material during backfilling.

Tennessee Gas, first major transmision company to make use of the new seal, reported highly successful results in speeding road crossings and insuring electrical separation between pipe and casing.

Usefulness of the seal was demonstrated recently where TGT's line crossed under a railroad track. The job was complete except for casing seals when one side of the 14-foot ditch caved in about the center of a side bend a short distance from the casing. The carrier pipe was pushed to one side of the casing. Ordinarily, the contractor would have had to excavate the pipe and bring it concentric with the casing in order to seal the ends. But with the new casing seal, the job of sealing carrier pipe and casing was completed in 15 minutes without the necessity of realignment. The contractor saved several hundred dollars.

Two major advantages of the new seal are its adaptability and insulating value. It is adaptable to all pipe diameters and when a casing has been insulated, installation of the seal over each end enhances electrical separation by preventing seepage of mud and water into the annular space between casing and carrier pipe.

2. The blanket is tucked out of the way and a light coat of plastic cement is brushed onto the carrier pipe. Slack left between carrier and casing allows for expansion.

3. The blanket material is cemented to the pipe, and secured by glass rope as shown, or by band clamps covered with protective tape to insure the band against corrosion

4. The seal is protected against backfill damage by wraps of pipe line felt held in place by bands covered with protective tape. Rock shields can be used where warranted.

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Instrumentation in Long Line Gas Transmission Systems

By E. S. PLANK

Tennessee Gas Transmission Company

FOLLOWING A GENERAL discussion of the operating theory and design features of various instruments, the author shows how instruments are applied to move gas from producing wells on the Gulf Coast to delivery points in eastern U. S.

INSTRUMENTATION in any gas transmission system, large or small, requires accurate measuring and controlling of these four variables:

Volume

Pressure

Temperature, and

Quality of the gas stream.

Today some long line gas transmission systems are handling as much as 1 million Mcf of gas per day, running 80,000 Mcf through individual meter tubes. Because gas sales, gas purchases and gas transmission are closely linked with instrumentation, company engineers and manufacturers are waging a ceaseless battle to improve accuracy in instrumentation.

Instruments Used On Pipe Lines

FLOW METERS. The orifice meter has two parts, the first being a special section of pipe (meter tube) which contains a disc or orifice plate which restricts flow, called the primary device. The second part of the installation is a gauge which measures the pressure drop across the restriction, called secondary device. This secondary device is a mercury float type instrument which operates on the same principle as a manometer.

During recent years great strides have been made in improving the orifice meter. Outstanding improvements are the teflon bushing in the pressure-tight stuffing box; the closer tolerances achieved in meter tubes; and the improved float assemblies. All of these improvements have contributed in achieving greater instrument accuracy. Today, orifice meter measurements can be accurate to .5 percent.

The formula for measurement of gas flow when using an orifice meter is $Q = C\sqrt{hP}$ in which Q is the quantity rate of flow at base conditions, C is the orifice flow coefficient, h is the differential pressure across the orifice plate, and P is the absolute static pressure of the flowing gas. It is necessary to control the volume of gas flowing through an orifice meter at a definite rate.

FLOW CONTROLLER. In some instances it is necessary to control the volume of gas flowing through an orifice meter. Since it is necessary to measure flow in order to control it, a basic instrument of the flow controller is a flow meter with an integral pneumatically operated flow control mechanism. Through a linkage arrangement from the differential pen arm to an air relay, the flow controller positions a throttling type valve in the pipe line to allow a fixed rate of flow through the orifice meter. If the static pressure in the pipe line is constant, then a fixed volume may be maintained by a predetermined index setting on the chart.

In case static pressure in the meter fluctuates widely, another element, the automatic pressure compensator, can be added. The compensator mechanism has a pressure element linked to the bearing shaft in such a way that the instrument reads the product of the differential (h) and pressure (P). This unit permits actual volume rate to be controlled directly with the index set to a special value, the controller operating to maintain the product of (h) and (P) constant.

AUTO SELECTOR. Figure 1 shows a dual purpose instrument consisting basically of two measuring systems actuating two flapper nozzle assemblies, connected to a single control relay. This instrument is essentially a limiting device.

Under normal operating conditions one unit is in command, operating the control valve to maintain flow or pressure at its set point. If conditions change such that, in order to maintain the first controlled pressure or flow at its set point, the extreme position of the control valve may cause the second flow or pressure to exceed certain limits. Under such conditions, as the second recording pen reaches its index pointer, which is set at some

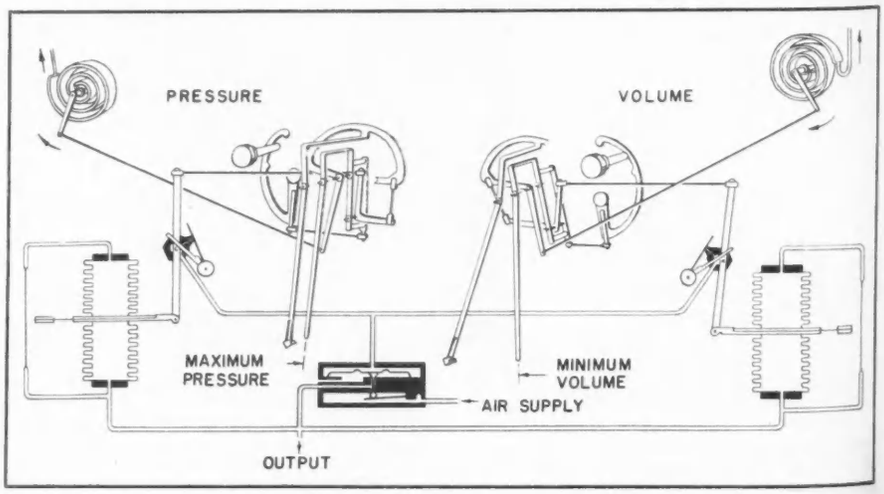

FIGURE 1

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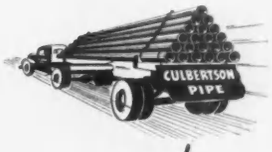

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predetermined value on the chart, it promptly overrides the first pen and commands the valve to prevent the second flow or pressure from exceeding a safe limit.

TEMPERATURE RECORDER. This instrument contains a thermal system consisting of a hollow metal bulb connected to a helical type pressure spring by capillary tubing. This system contains a fluid sensitive to temperature change and is hermetically sealed. Changes in temperature cause proportionate changes in the pressure within the system, and the pressure is measured by the accurately calibrated helical spring. By a linkage arrangement the movement of the helical spring is transmitted to a pen arm which records temperature on a chart calibrated in degrees Fahrenheit.

TEMPERATURE CONTROLLER. This uses the temperature recorder as the basic instrument. By a linkage arrangement from the temperature pen arm assembly to an air relay, similar to that in the flow controller, a control valve is positioned to maintain the process temperature at the desired point of control.

PRESSURE CONTROLLER. This positions a control valve in the pipe line to maintain the static pressure at some predetermined point, by setting the pointer on the proper index setting.

The instrument consists of a spiral pressure element as the measuring element. Movement of the pressure element is transmitted through a link to the indicating pointer, which in turn carries the motion to a flapper. Motion of the flapper changes the nozzle air pressure which is transmitted to the control relay, causing a flexure of the diaphragm and a change in relay output pressure. The relay output pressure operates the control valve.

Relay output pressure is transmitted to the proportioning bellows, as well as to the control valve. The relay output pressure can vary between minimum and maximum, resulting in proportioning action of the control valve within its operating range of air pressures. Through reaction on the process the control valve stabilizes at some intermediate position between open and close.

RECORDING GRAVITOMETER. Since the accuracy of the measurement of a volume of gas is dependent upon knowing its specific gravity, it is necessary to obtain the value of this factor by means of a recording instrument. This instrument is known as a recording gravitometer, which is illustrated in Figure 2.

Fundamentally, the most accurate method of measuring the specific gravity of gas is to actually weigh it. A large float approximately one cubic foot in volume is used to receive the gas. The gas sample is weighed in the atmosphere by a balancing mechanism, and a continuous record of the weight is recorded on the chart.

The gravitometer consists essentially of a balance which weighs the difference between the weight of a certain volume of air and the weight of the same volume of gas under the same conditions. The gas is contained within the float, which is suspended from a balanced bar by stainless steel knife edges and hook bearings. The weight of the metal in the float is counterbalanced by a set of balancing weights; therefore, the source which moves the balance bar, and consequently the pen arm, is derived from the difference in the weight of the gas in the float and the bouyancy of the air displaced by the float.

Since the difference in weight between the same volume of air and gas is the force actuating the gravitometer, the instrument can be calibrated by testing with a set of standard weights.

RECORDING CALORIMETER. Inasmuch as gas contract agreements require that the natural gas contains a certain number of heat units known as British thermal units, an instrument known as a recording calorimeter is used to evaluate and record this quality. The recording calorimeter consists of two units, the

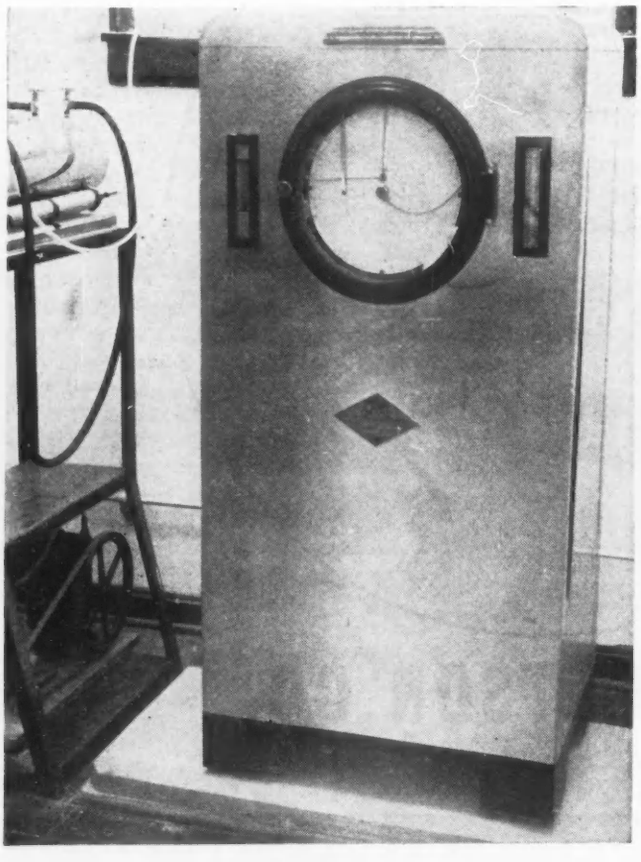

FIGURE 2

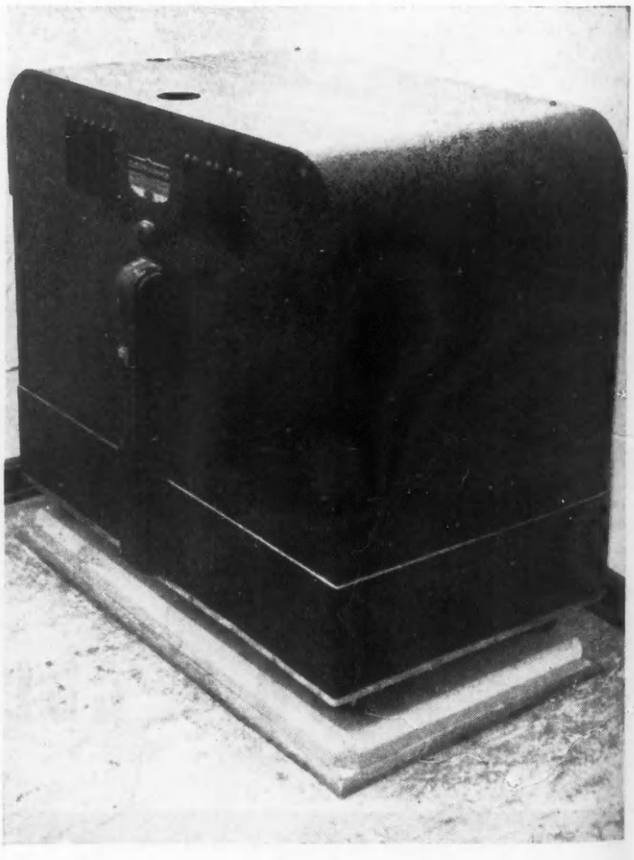

FIGURE 3

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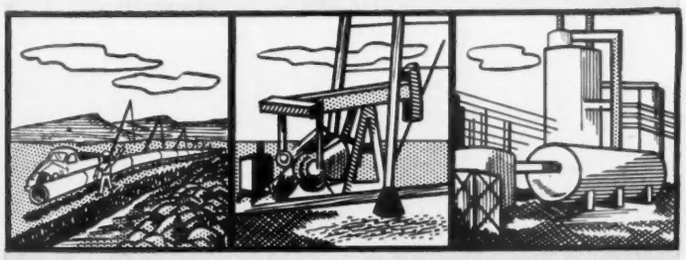

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tank unit or calorimeter proper which measures and burns a small sample of gas, and the recorder which translates the results into a continuous graphic record of gas heating value in Btu per standard cubic foot. Figures 3 and 4 show a typical installation of the Type AB recording calorimeter.

In the calorimeter proper are three water sealed displacement pumps or meters geared together and driven by a common motor. One meter supplies gas for testing; a second supplies the air for absorbing heat of combustion; and a third supplies the air for combustion. Since all three are geared together, air and gas are always delivered in fixed volumetric proportion. To insure proper water level in the main tank containing the meters, a small pump supplies water from an auxiliary tank, and maintains a circulation of water through the overflow weir in the main tank.

The sample gas enters the calorimeter through a small orifice and is delivered to the inlet chamber of the gas meter. A bleeder burner connected to the gas meter inlet chamber maintains atmospheric pressure in the gas meter and insures a fresh sample of test gas at the instrument. The gas at approximately atmospheric pressure with the proper proportion of primary combustion air is delivered to the burner where combustion takes place. Through separate piping, secondary air from the combustion air meter is delivered to the burner to give complete combustion.

The products of combustion then pass out of the bottom of the burner after giving up their heat to a stream of heat absorbing air.

Two sensitive, nickel resistance thermometers measure the temperature rise of the heat absorbing air as it passes through the calorimeter burner. The inlet thermometer is located at the point where the air is delivered from the heat-absorbing meter to the burner. The outlet thermometer is so placed in the polished nickel burner jacket that it provides an accurate indication of the temperature of the air after it has passed through the burner and has absorbed all of the heat developed in the combustion of the test gas. These two electrical thermometers are connected by copper wires to the calorimeter recorder and form two legs of a wheatstone bridge circuit.

The other two legs of the bridge system are fixed resistances located in the calorimeter recorder. A resistance slide wire mounted on a shaft in the recorder and connected to a contact finger is rotated by the recorder mechanism to balance the resistance in the bridge circuit. The position of the slide wire is an indication of the resistance difference between thermometers A and B and therefore a measure of the temperature rise of the heat absorbing air as it passes through the calorimeter burner. By means of a pen attached to the slide wire the movement of the slide wire is recorded on a strip chart which is graduated to record the heat rise as Btu units per standard cubic feet of gas.

With the advent of long line gas transmission systems, all the old problems of instrumentation and control were presented together with a few new ones. A continuous effort is exerted to improve the instruments to combat these problems.

Figure 5 is a strip map showing the entire Tennessee Gas Transmission Company system, on which is indicated the various gas purchase points, compressor stations and gas sales points, by the respective symbols A, B, and C. Each of these points incorporates the use of one or more of the instruments described in the first part of this paper.

A. Instrumentation at Source of Supply

The supply of natural gas feeding TGT's system is furnished by natural gas wells and natural gasoline processing plants in the Texas-Louisiana Gulf Coast area. Figure 6 is a schematic drawing of a typical connection with two producing wells, with the attendant instruments and controls necessary to measure and control volume, pressure, temperature and quality of the gas. The volume of gas from the wells is controlled by employing the use of an adjustable choke and the pressure is controlled

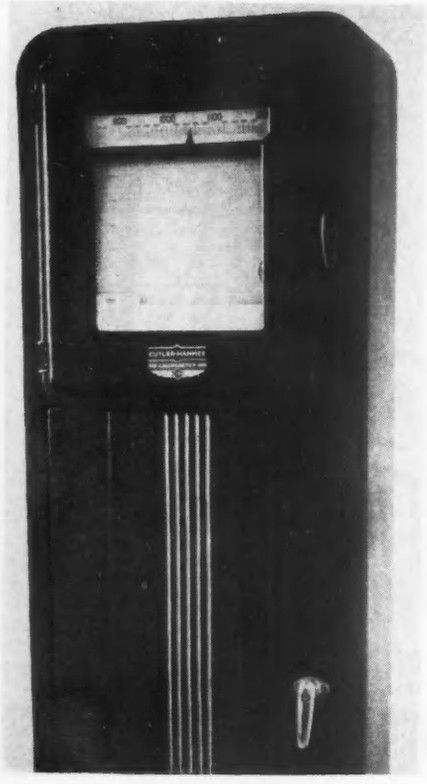

FIGURE 4

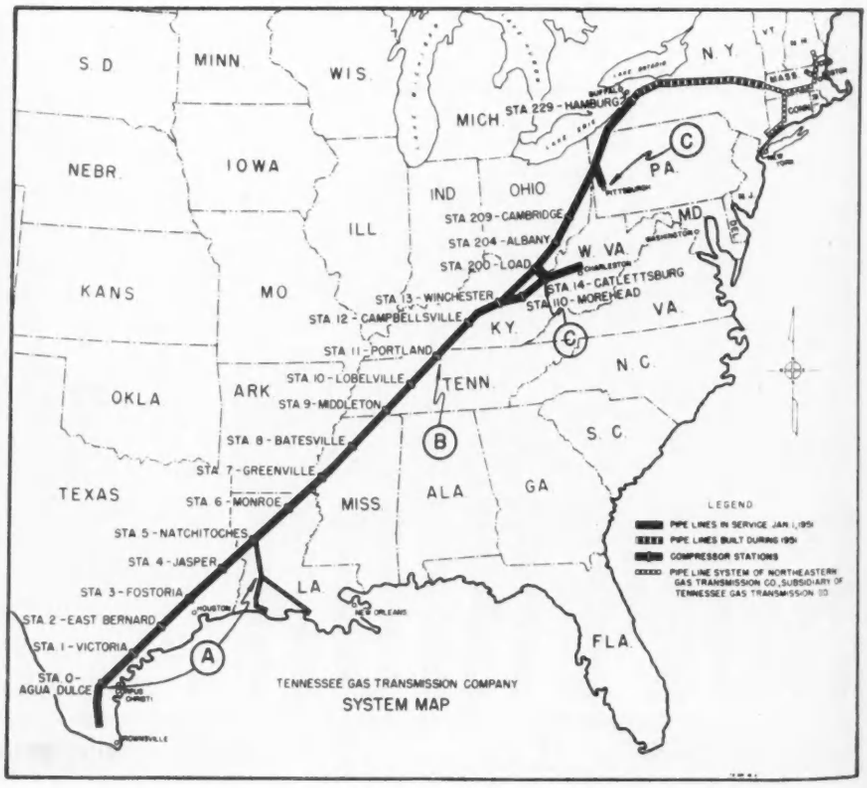

FIGURE 5

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by employing the use of a pilot operated type pressure reducing regulator to allow the gas to enter the gathering pipe line at operating line pressure of 600 to 800 pounds per square inch gauge.

All natural gas produced from a gas bearing sand is usually saturated with water vapor at the operating pressures and temperatures. It is therefore necessary to remove the water vapor in order to eliminate the possibility of condensing the vapor into free water when the temperature and pressure conditions are lowered and to eliminate the hydrating or freezing of the water vapor due to the gas flowing temperature dropping below the dew point.

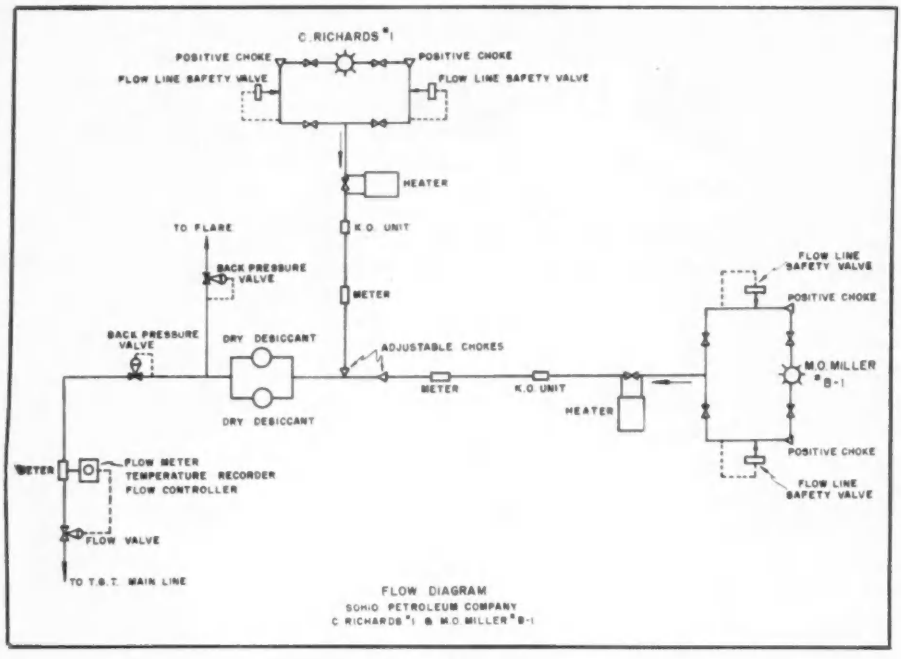
In order to remove water vapor from the gas stream, a dry desiccant-type gas dehydration unit is used. These units have two contact towers, one to dehydrate the gas stream while the second is being reactivated or regenerated. The operation of these plants is usually performed by full automatic controls (Figure 7).

Instrument at left is used to divert gas through the plant heater to accomplish regeneration. The other is a time cycle controller used to automatically switch the plant processing. This time cycle controller employs two cams. One cam switches the main gas stream from one tower to the other by operating a three-way motor valve which actuates the two sets of motor valves.

The second cam causes a motor valve to bypass the plant heater with regeneration gas for two hours in order to cool the desiccant bed before accepting the main stream for dehydration.

The two cams are operated by a common mechanical-wound drive, in order to keep the two operations in phase.

Figure 8 shows a gas supply point where Tennessee receives about 160,000 Mcf of processed gas from a gasoline plant. This gas is dehydrated through a dehydration plant similar to the one shown for the producing wells connection. This delivery point incorporates the use of flow meters, flow controllers and temperature recorders which maintain such gas volumes as called for by the Dispatching department, at a constant rate. The specific gravity value of the gas being delivered is obtained by a recording gravitometer. The quality of the gas as to Btu value is obtained by a continuous sampling of the gas stream through a recording calorimeter.



FLOW DIAGRAM
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FIGURE 6

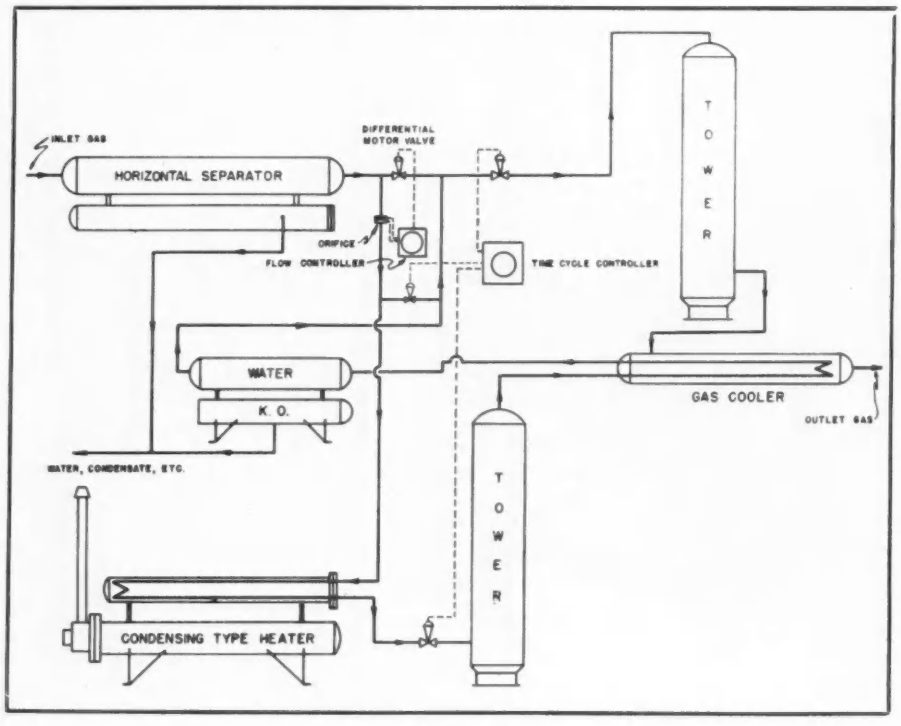

FIGURE 7

B. Instrumentation in Transmission

In moving the natural gas through the approximately 2000 miles of one pipe line, the initial pressure of the gas is reduced due to friction in the line. Compressor stations at strategic points recompress or boost the gas to or near its original pressure. These compressors use direct connected natural gas engines for power. The fuel for the gas engines is taken direct from the pipe line and the pressure, volume and temperature is controlled and measured by pilot operated control valves, flow meters and temperature recorders, as shown in Figure 9.

The operation of the compressors require the use of water for cooling. In order to maintain proper temperatures in the water cooling system, the temperature controller is employed.

C. Instrumentation at Sales Points

When gas arrives at the Eastern market, the problem of measuring and controlling volume, pressure and temperatures again presents itself. The quality of the gas which was established at the source of supply has not changed appreciably.

Majority of TGT gas sales contract agreements require that the volume

of gas delivered be measured accurately and controlled at a fixed rate with little variation. A pressure compensating flow controller is employed to maintain delivery-point volumes. Day to day variation in volume does not exceed 5 percent.

The delivery of gas to some customers requires the limiting of pressure on the customers' line as well as controlling the volume. An auto selector instrument is used to handle this problem. Under normal conditions this instrument will maintain the gas volume at a fixed rate until such time as the customers' gas pressure reaches a predetermined maximum; then the second unit in the auto selector commands the control valve. When the customers' pressure drops below the set limit, the first unit in the instrument takes over and operates to control volume again.

Recording gravitometers are located at stragetic locations in the sales area of the pipe line wherein the specific gravity of a continuous sample of gas is evaluated. Records from the charts removed from these instruments are used as control in deriving correction factors used in calculating the gas volume through the various sales meters.

A recording calorimeter is installed at each recording gravitometer location in order to obtain a continuous record of the Btu value of the gas being delivered to each customer. Gas sales contract agreements require adjustment for the Btu value of the gas only when this value is below 1000.

Instrumentation in long line gas transmission requires the gas company engineers to exert every effort to obtain instruments to measure volume, pressure, temperature and quality of the gas, which are designed to do each job with the greatest amount of dependability and still obtain the greatest degree of accuracy. If this is done, then the gas systems will tend to operate smoothly and economically, which in turn assures dependable service to customers.

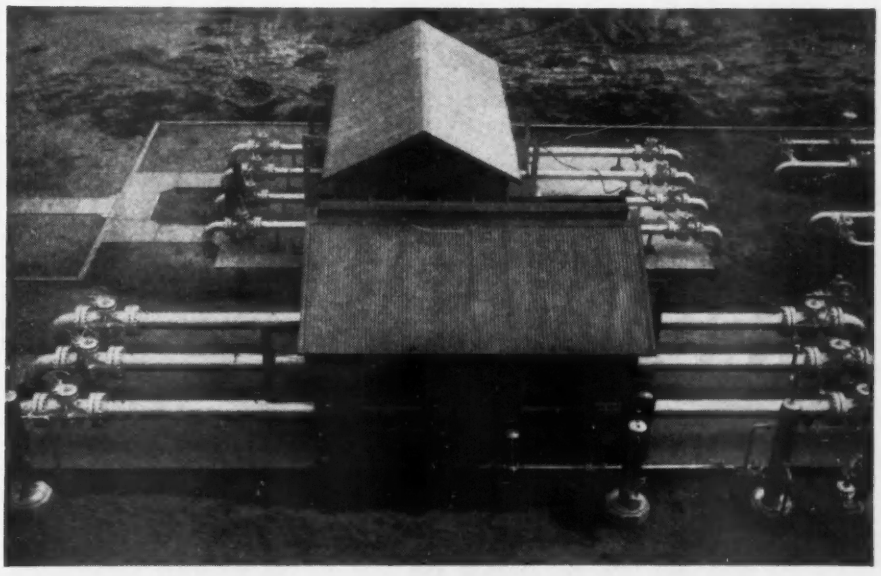

FIGURE 8

FIGURE 9

About the Author

EDWARD S. PLANK, gas measurement superintendent of Tennessee Gas Transmission Company, has had 28 years experience in natural gas and allied fields. Born in Grove, Okla., he attended the University of Oklahoma and Kendall College, now The University of Tulsa. He started work for Oklahoma Natural Gas Company as a measurement engineer in 1923. Later he was division superintendent of Southern Union Gas Company, measurement engineer with Northern Natural Gas Company and superintendent of the Gas-Gasoline department for Southport Petroleum Company. He has been with TGT since 1944.

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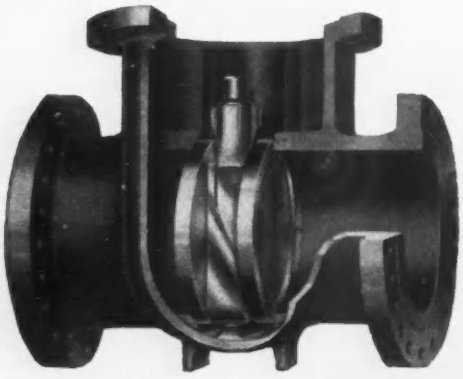

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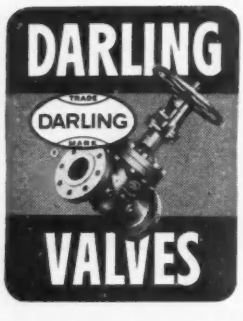

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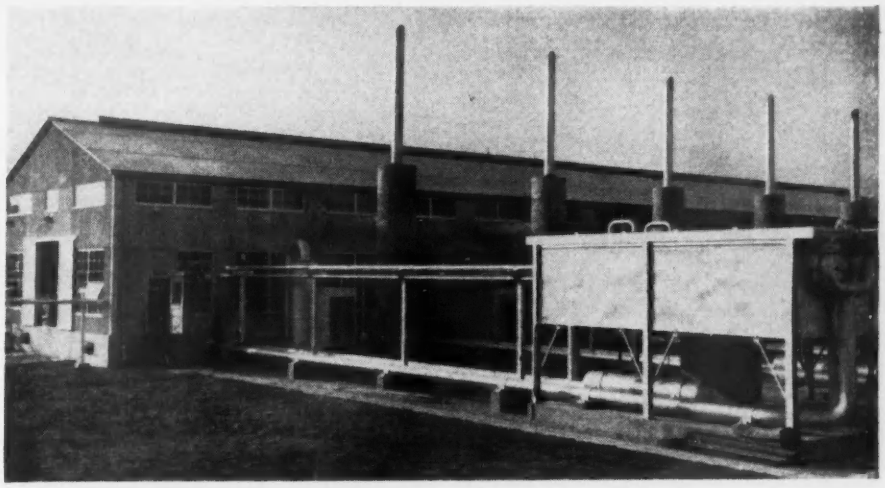
APPLICATION OF hydraulic drive to power auxiliary units at Transcontinental Gas' Compressor Station 19 was a radical departure from conventional design aimed at minimizing capital investment, obtaining a highly flexible operation and using small maintenance and operating crews. These advantages have materialized in three months' operation.



Transcontinental Gas' Compressor Station 19 at Ellicott City, Md., makes use of hydraulic drive to power auxiliary units. Note heavily insulated silencers which minimize noise in the thickly populated area.

Application of Hydraulic Drive To Compressor Stations

By CRAIG LAZZARI

Project Engineer, Fish Engineering Corporation

HYDRAULIC drive was incorporated in the design of a Transcontinental Gas Pipe Line Company compressor station to obtain maximum flexibility of operation and to eliminate the need for auxiliary building and generators.

Two tandem hydraulic pumps connected to the crankshaft of individual compressor engines furnish power to drive jacket water pumps and fans in in atmospheric cooling sections which cool discharge gas and engine jacket water.

The compressor station at Ellicott City, Md., has 12,000 horsepower which would normally require installation of three 250 kilowatt auxiliary generators, one of which would be a spare. By utilizing compressor engine power to drive auxiliary units, the three generators were eliminated, replaced by one 50 KW engine-generator which provides power in case of emergencies. Electric power for station lighting, water well pump, oil reclaimer pump, utility pump, hydraulic oil circulating pump, scrubber oil pump, air compressor, heating boiler and unit heaters, and radio tower primary feeder is purchased from the Consolidated Gas Electric Light & Power Company of Baltimore. The above units, driven by power furnished from an outside source, represent an approximate maximum instantaneous load of only 23 KW.

A stub shaft bolted to the flywheel of each compressor drives a speed increaser through a non-reverse coupling. The speed increaser has a 1 to 3.86 ratio and the high speed shaft turns 1158 revolutions per minute at the rated speed of the compressor engine. The hydraulic pumps are driven off the high-speed shaft of the speed increaser and take suction from a common header. A strainer provided in the suction line prevents foreign particles from entering and injuring the close-tolerance parts of the pumps. One of the hydraulic pumps pressures oil to the hydraulic motor driving the jacket water pump. Curves 1 and 1A on Figure 1 show the characteristics of the hydraulic pump. A bypass around the motor permits transmitted power adjustments. The bypass valve is set when operating at rated compressor engine peed. When operating at reduced engine speeds the power output characteristics of the hydraulic system coincide with the power requirements of the jacket water pump. The hydraulic oil is piped back to a common header in which a pressure of 40-45 pounds per square inch is maintained.

Oil from the second hydraulic pump furnishes power to drive the gas and jacket water air cooler fan. Curves 2 and 2A, Figure 1, represent the pump characteristics. The cooling requirement of each compressor is provided by a single cell air cooler equipped with a 16-foot fan. The hydraulic motor drives the fan through a right angle speed reducer. Rated fan speed is 213 rpm at the rated load of the compressor engine. A control valve bypasses the hydraulic oil around the motor, providing automatic variation in fan speeds. The bypass control valve is actuated pneumatically by a temperature recorder controller regulating the jacket water temperature out of the compressor engine.

Figures 3 and 4 offer an interesting

About the Author

CRAIG LAZZARI joined Refinery Engineering Company doing drafting and design in 1942 after being graduated from Michigan College of Mining and Technology with a degree in mechanical engineering. He worked on design of a rubber plant with Ford, Bacon and Davis before entering the U. S. Navy where he served two years. On discharge, he joined Petroleum Engineering, Inc., of Houston as assistant chief engineer. Now a project engineer with Fish Engineering Company, Houston, Lazzari helped design Transco's compressor stations.

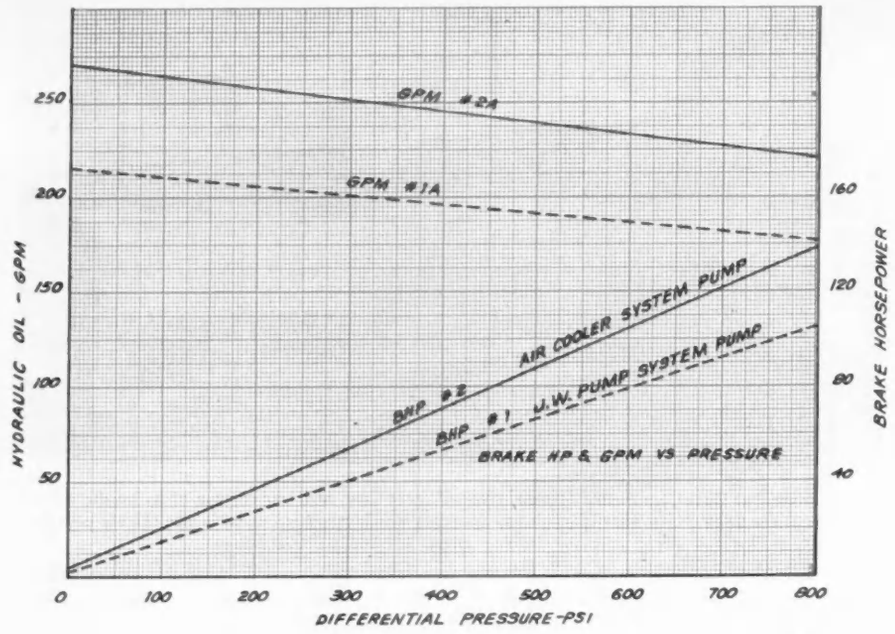


FIGURE 1.

study on the advantage of a variable speed drive on air cooler service when each compressor is unitized. Figure 3 shows theoretical horsepower requirement of three air cooler drive systems with varying ambient air temperatures. Figure 4 shows the actual horsepower requirements of the three systems. Curve 3 on Figure 3 represents the theoretical horsepower required with varying air temperature. Such a curve could only be attained with a 100 percent efficient variable speed drive. Curve 2 is based on seven cells, each equipped with two-speed motors connected in parallel and the power requirements prorated per cell. Such a system, because of its flexibility, simulates variable speed operation.

To save power, the fans of each cell are turned on at half speed on the flat portion of the curve to 60° F. air temperature. As the air temperature increases above 60° F. the fans are switched to full speed operation progressively and at 94° F. all the cells are operating at rated capacity. Curve 1 represents the theoretical power requirements of a single cell equipped with a two-speed drive system.

Curve 3 on Figure 4 is the actual horsepower-air temperature relation of the air cooler hydraulic system at Transco, Station 19. The over-all efficiencies of the unit, including hydraulic motor, pump, and right angle gear may be computed by dividing points on Curve 3 of Figure 3 with identical points of Curve 3 on Figure 4. Curves 2 and 3 are computed with a 74.6 percent over-all efficiency at half speed and 79.8 percent over-all

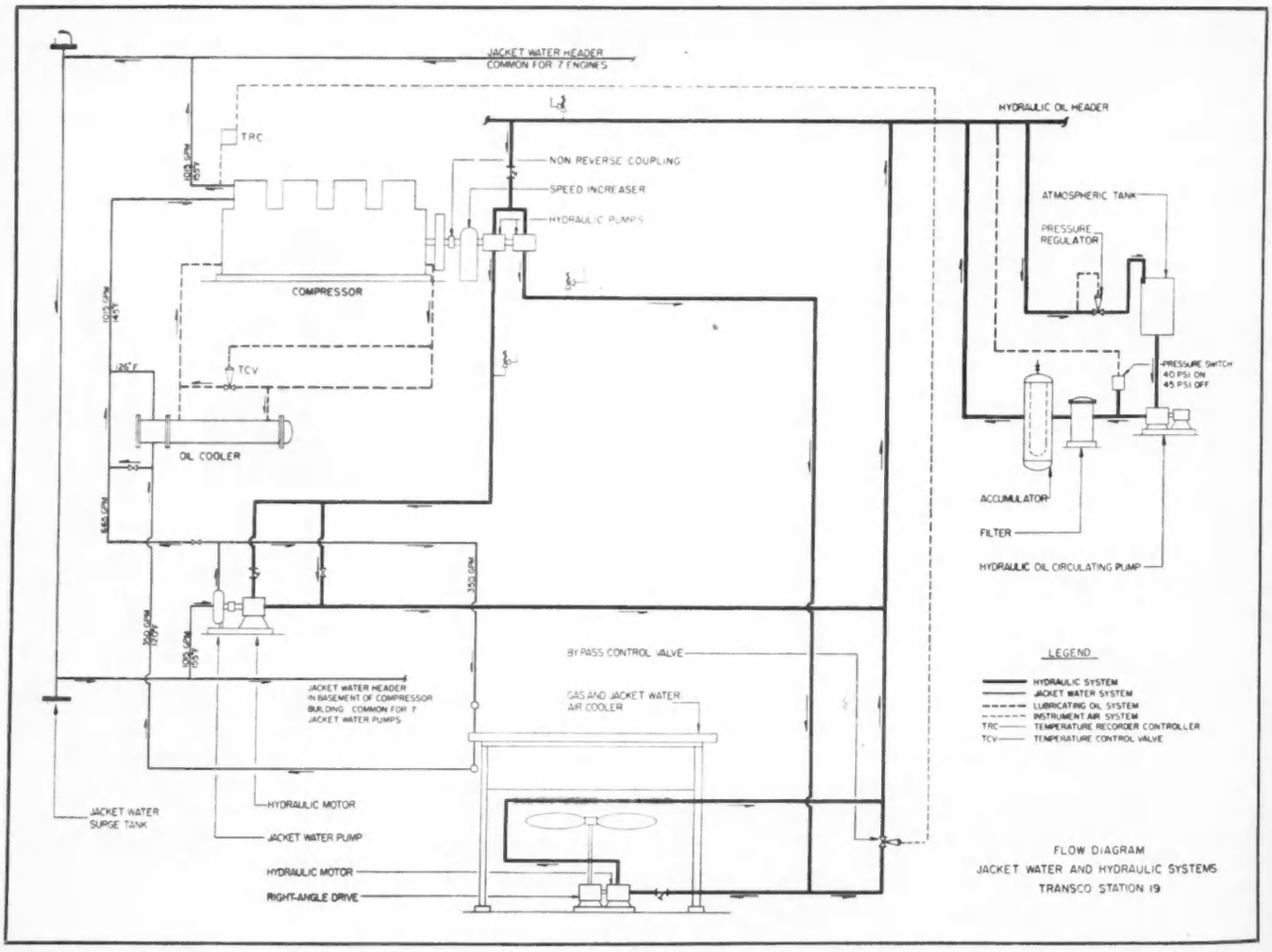
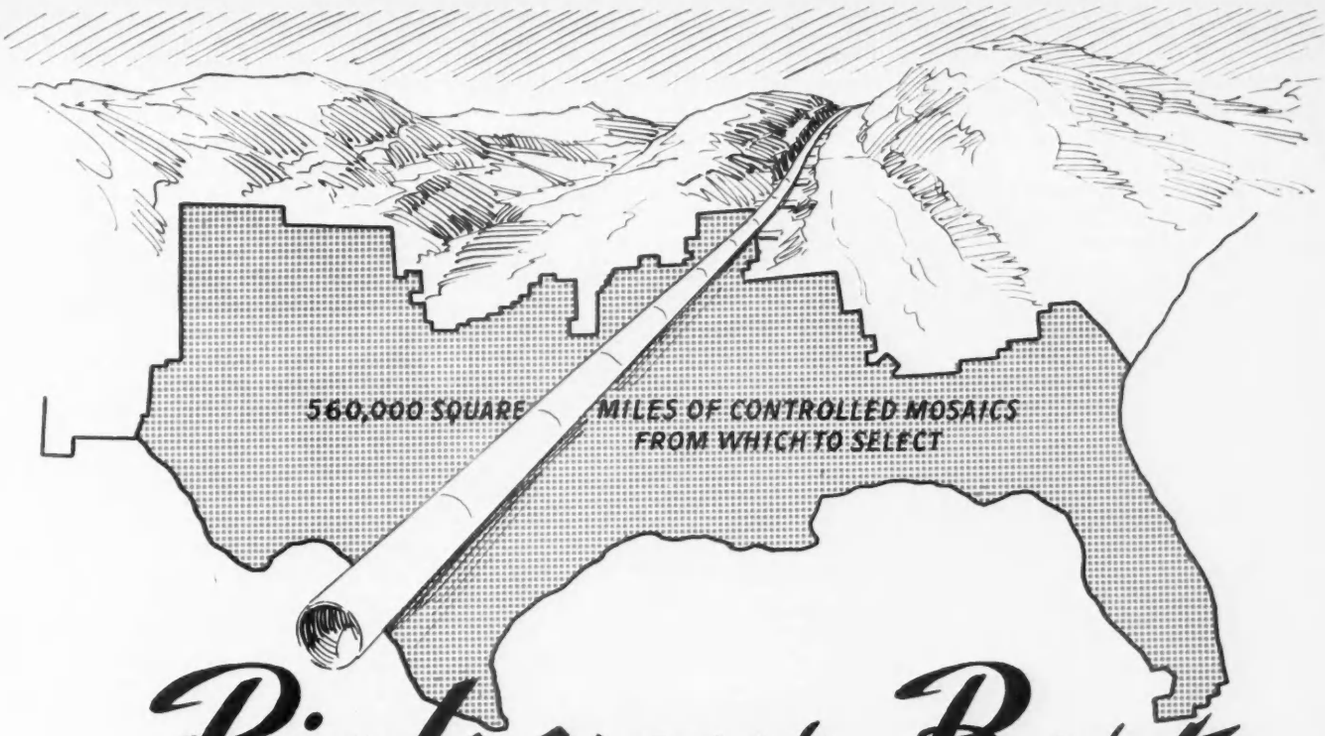


FIGURE 2.



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efficiency at full speed. The over-all efficiency of the drive system includes the generator loss exclusive of the engine drive, the two-speed single winding electric motor loss, and the power loss in the right angle gear drive.

The actual power consumption of operating on Curve 1 is 287,500 brake horsepower hours per cell per year. The actual power consumption of operating on Curve 2 is 108,962 bhp hours per cell per year and Curve 3, 121,541 bhp hours per cell per year. Since each air cooler at Station 19 serves one compressor, the comparison is between Curves 1 and 3 operation. All other Plan 2 station jacket water systems have a multi-cell cooler, all cells connected in parallel. Curve 2 was added to compare the efficiencies of the two systems. Thus it appears that Curve 2 operation, if properly controlled, is approximately 10.5 percent more efficient than Curve 3 operation because of the higher efficiency of electric drive.

The fuel gas consumption of each Transco station is available for checking against the cubic feet per bhp hour fuel consumption of Station 19; however, none of Plan 2 stations have operated long enough to supply accurate information for comparison.

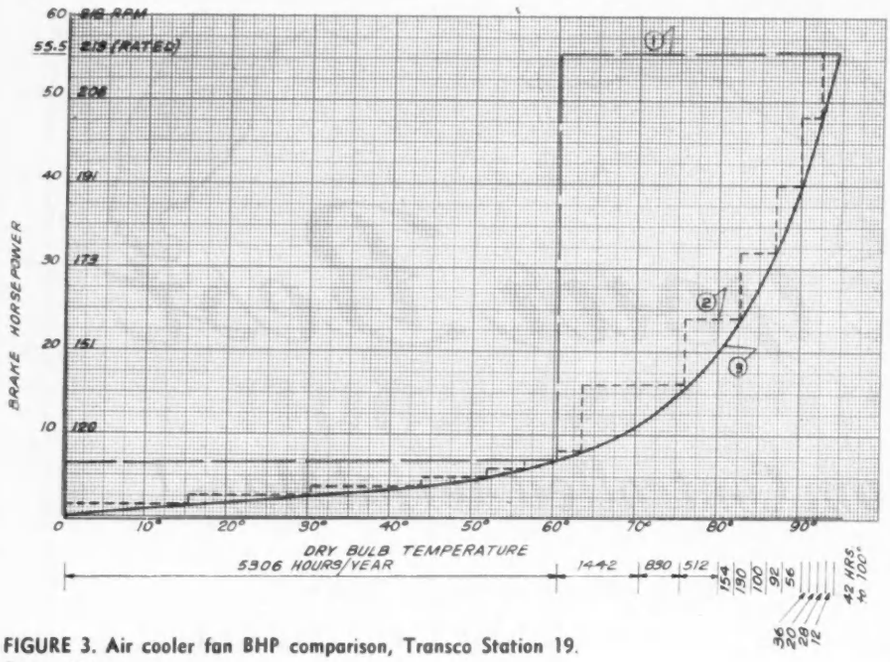


FIGURE 3. Air cooler fan BHP comparison, Transco Station 19.

General Notes:
(a) Hours indicated are hours per year that indicated temperature will occur.
(b) All curves are theoretical BHP requirements. Efficiency of each system is not considered.

Code:
(1) Theoretical BHP, single cell operating w/2-speed, 1800/900 rpm motor.
(2) Theoretical BHP—7 cells in parallel, each w/2-speed 1800/900 rpm motor, prorated for single cell.
(3 Theoretical BHP of fan, variable speed.

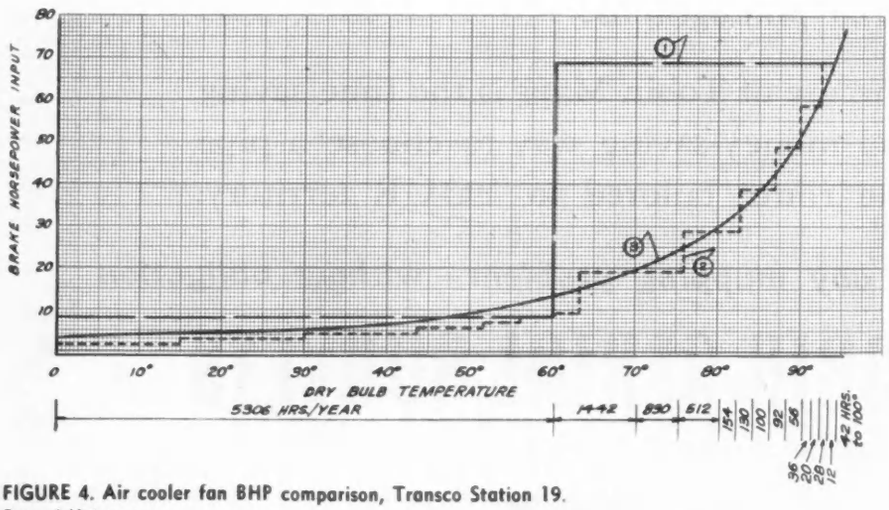


FIGURE 4. Air cooler fan BHP comparison, Transco Station 19.

General Notes:
(a) Hours indicated are hours per year that indicated temperature will occur.
(b) All curves are actual BHP requirements. Efficiency of each system is considered. See text for efficiencies.

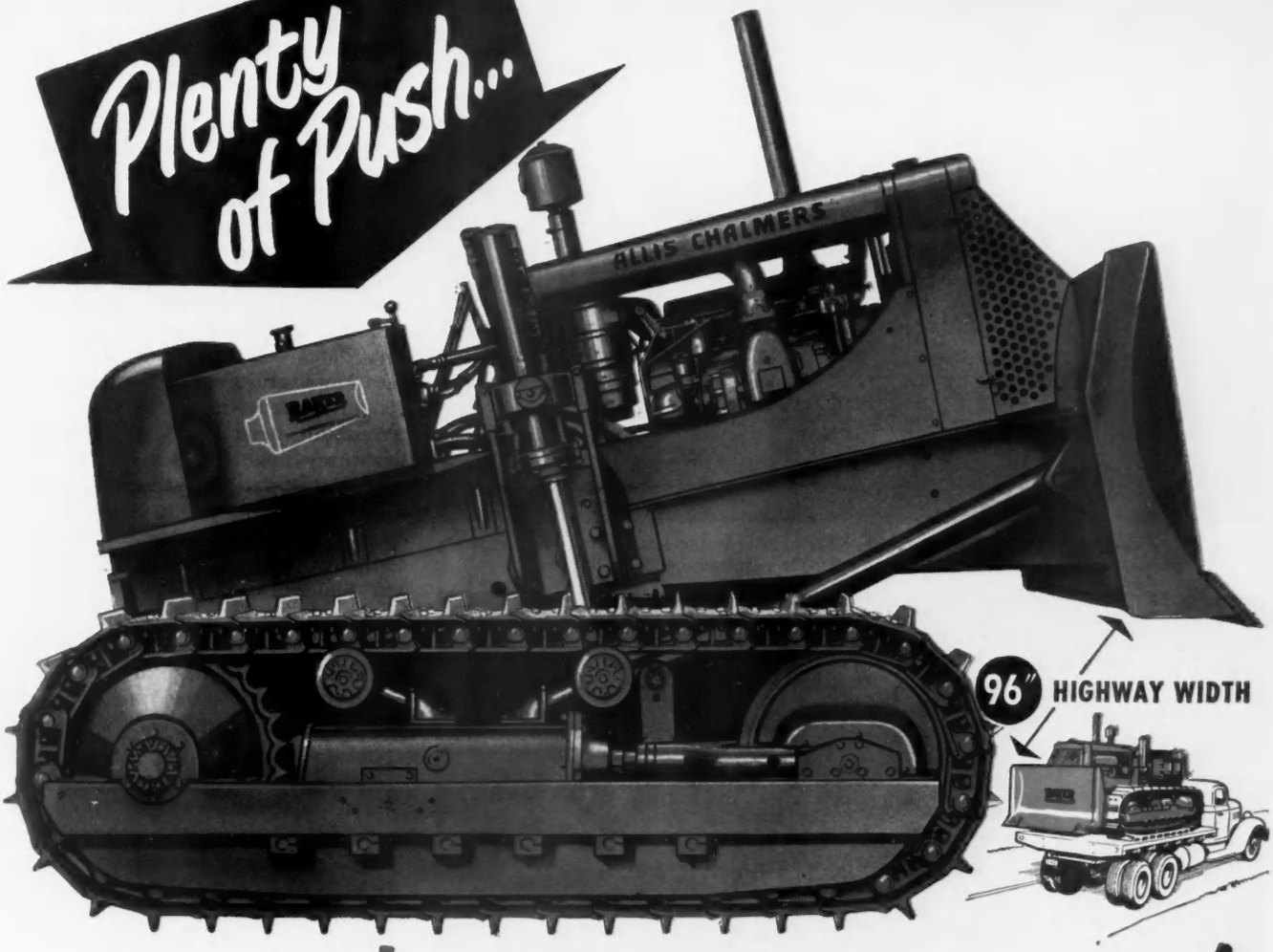
Code:
(1) Actual BHP, single cell operating w/2-speed 1800/900 single winding motor.
(2) Actual BHP—7 cells in parallel, each w/2-speed 1800/900 rpm single winding motor, prorated for single cell.
(3) Actual BHP of variable speed hydraulic driven fan.

The hydraulic oil out of the fan motor is passed through a finned cooling section underneath the main cooler sections. The oil cooler is provided to limit hydraulic oil temperatures to 125° F. The oil is returned to a common header pressured to 40-45 psi with the hydraulic oil recirculating pump. If the pressure exceeds 45 psi due to a sudden surge, a control valve releases oil to an atmospheric tank. If the pressure in the header drop below 40 psi, the hydraulic oil recirculating pump starts automatically and pressures the system. A ten-gallon capacity bladder-type accumulator is provided in the recirculating system to give it compressibility. The accumulator cuts down operation of the recirculating pump to an average of two minutes out of every hour. The recirculating pump also serves to charge the hydraulic system. A filter installed on the pump discharge removes foreign particles from the oil.

Jacket Water System

Each air cooler is equipped with two finned sections for jacket water cooling and two sections for gas cooling. Rather than pass the entire jacket water supply through the cooler, only a portion of the amount recirculated by the jacket water pump is cooled. This practice keeps the size of the air coolers to a minimum. A jacket water temperature of 120 degrees out of the cooler is generally considered the lowest attainable with 100 degrees ambient air temperature, and the design of the cooling unit was based on that fact. Heat dissipated by the compressor engine jacket and the lube oil cooler at full load is removed by cooling 350 gallons per minute of jacket water, 35 degrees. The jacket water pump handles 1015 gpm, 665 gpm of which is recirculated at 155 degrees, the controlled outlet temperature less heat losses. The split in the jacket water pump effluent is effected by a manually set globe valve. This valve affords a coarse adjustment in diverting an ample supply of water through the jacket water cooler. A second bypass is installed around the lube oil cooler. This bypass is also manually operated with the valve set to divert a portion of the 350 gpm from going through the lube oil cooler. Attention is called to the fact that the bypasses mentioned need not be reset periodically since the variable speed cooler fan automatically adjusts for correct water temperature. A temperature control valve on the oil side of the

Plenty of Push...



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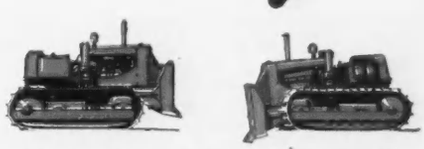

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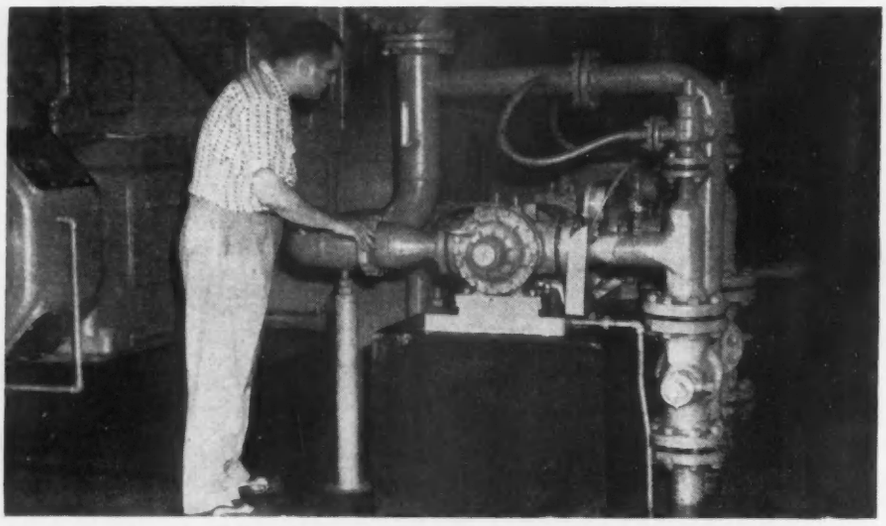
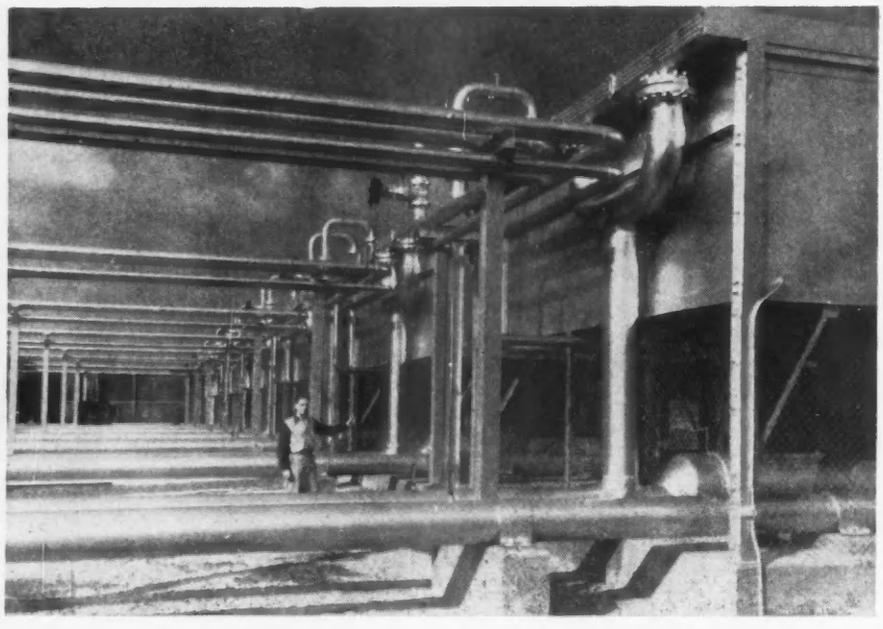
Station Superintendent W. H. Buckingham checks oil level in right angle gear drive which transmits engine power to hydraulic system.



Transcontinental Gas' assistant chief engineer, Robert L. Topper, inspects the two tandem hydraulic pumps on the flywheel end of each engine. They furnish power for the hydraulic drives.



Combination jacket water and discharge gas atmospheric cooling sections. The large diameter piping is gas; lines atop pipe stanchions are jacket water; and the four-inch lines are hydraulic oil leading to hydraulic motor underneath the coolers which drives the cooling fan.

lube oil cooler maintains a constant oil temperature out of the engine.

Gas System

The compressors pump gas from a common header. The gas is discharged through two finned sections in the individual air cooler into a common header. An expansion chamber for pulsation dampening is provided ahead of the air cooler on each discharge lead. A method of controlling the gas temperature out of the cooler is not provided; however, the temperature is confined to a reasonably narrow range well below the maximum permissible pipeline temperature. Since the heat of compression in the gas, and the engine heat dissipated to the jacket water are related, the control on the jacket water temperature indirectly regulates the gas temperature in to the transmission line.

The side gate valves on the station suction and discharge lines and the main line bypass are pneumatically operated. The same valves are electrically operated at all other Transco stations.

The compressors at Station 19 were not furnished with a direct-driven jacket water pump. If a direct-drive jacket water pump on the compressor had been available, a hydraulic driven unit would not have been installed.

The hydraulic drive for the air cooler system could be simplified by direct driving a hydraulic pump off the compressor engine. This practice would eliminate the use of a speed increaser and greatly improve the general appearance of the installation by removing all of the equipment from the flywheel end of the compressor. Compressor manufacturers would do well to consider the possibility of providing a power take off for a standard make 70-80 hp at 1200 rpm hydraulic pump.

The following advantages may be listed for hydraulic drive systems:

- Lower capital investment per installed horsepower.
- Maximum flexibility of operation. Where operating conditions are favorable, this advantage is beneficial in storage pool pumping.
- Less operational labor. The elimination of the auxiliary equipment requires one less operator per shift.

ACKNOWLEDGMENT

The author wishes to thank C. F. Taylor, Jim Elizardi, LeRoy Swift of The Rockwell Manufacturing Company, the Marley Company, and Griscom-Russell Company, respectively, for their assistance.

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Elimination of the chassis, control of dirt direction by guards over the digging mechanism, and hydraulic brakes on the truck give the ditcher a remarkable safety record. From his extended seat, the one-man ditching "crew" operates the truck and ditcher entirely from controls and gear box within the cab and he can watch the operation as it progresses.

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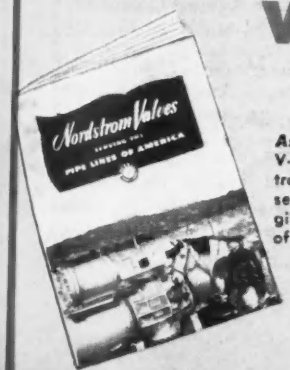

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A Bibliography on
CATHODIC PROTECTION

By F. A. ROHRMAN

Executive Director, Engineering Experiment Station,

University of Colorado, Boulder

SINCE the publication of a "Bibliography on Cathodic Protection" by the writer in WORLD OIL, for July, 1950, several addenda and errata are added for the sake of completeness and accuracy. The literature for the year 1950, is also included.

This makes this bibliography complete up to 1951. As indicated in the initial publication, the material is arranged by the year and alphabetically by the authors under each year. In order to make the material more readily useful, each inclusion is preceded by the letters (A), (E), (G), (M) or (Z) which establish the main nature of the treatment of each paper. The letter (A) will mean that the main import or subject matter of the paper refers to aluminum, (M) to magnesium, and (Z) to zinc as anode materials. The letter (E) will indicate that the paper treats most specifically with external electrical means of cathodic protection or with resistivity measurements, electric connections, cells, etc. (G) covers the more general aspects of cathodic protection and also those cases where more than one type of anode (Al, Mg, or Zn) is discussed.

All references list the author, or authors, the title of the paper, the journal, volume, page, and year, in uniform order.

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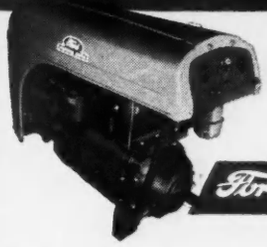

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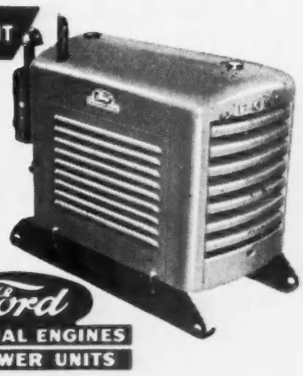

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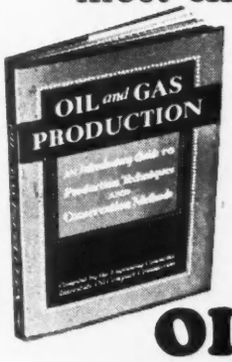

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BETTER SADDLES

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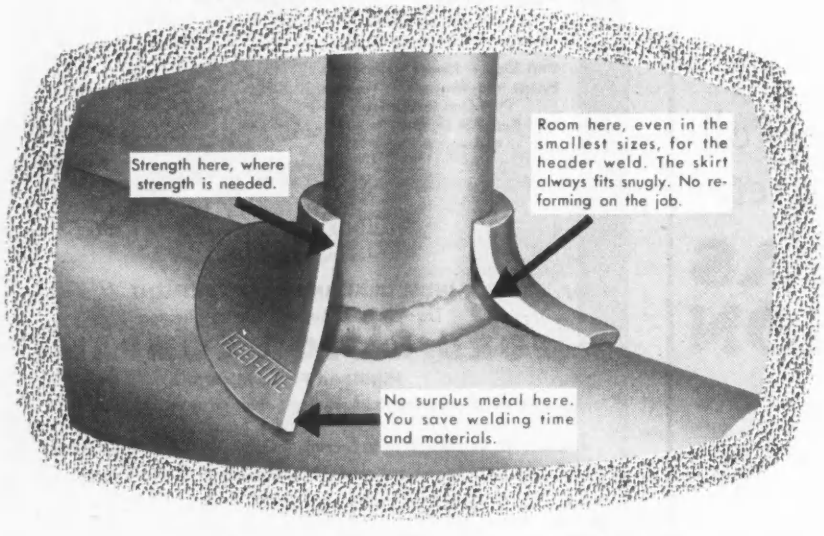
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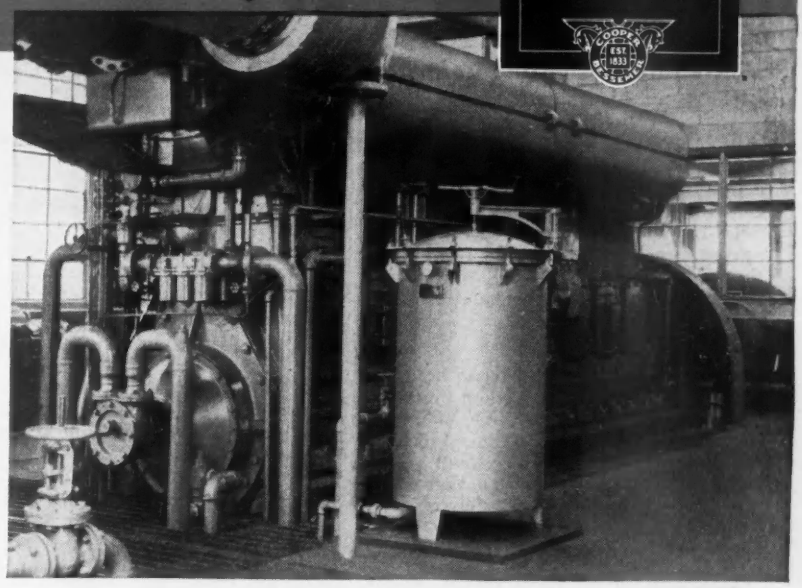


Cooper-Bessemer LS-8 supercharged gas-diesel, 1,715 hp in Mid-Valley Clarkson station. Line will soon have 15 LS-8's, 12 of which are gas-diesel and 3 of which are diesels, plus 9 JS-8 supercharged gas-diesels.

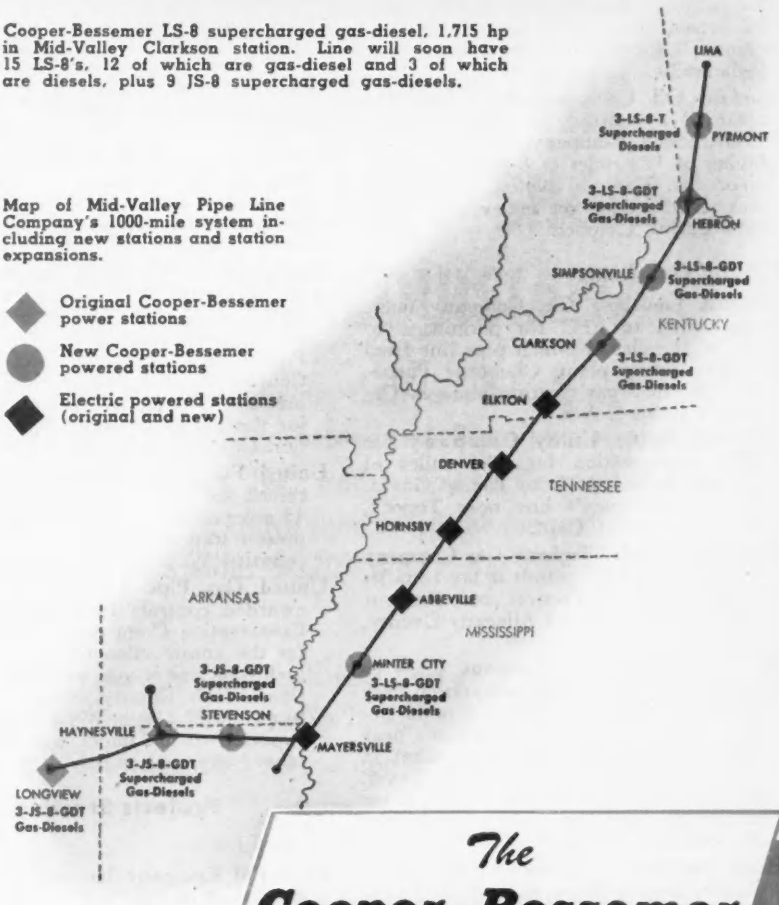
The capacity of the Mid-Valley Line, already one of the nation's largest oil line systems, will soon be expanded by the addition of 26,465 Cooper-Bessemer diesel and gas-diesel horsepower.

From the very beginning, the planning that went into the Mid-Valley Line took advantage of the latest developments in power and pipeline engineering to gain optimum operating economy. And, since Mid-Valley has had experience with their original Cooper-Bessemer Gas-Diesels, there's plenty of proof that these modern, smooth-running engines have what it takes, while considerably bettering their attractive guarantees.

The Mid-Valley Line's latest Cooper-Bessemers will power four new booster stations, and will increase the power in each of the four original engine-driven stations. This calls for five JS-8 supercharged Gas Diesels, eight LS-8 supercharged Gas-Diesels and three LS-8 supercharged diesels. In addition, the four JS-8 atmospheric engines originally installed in the Longview and Haynesville stations are being converted to supercharged gas-diesel operation. Thus all engines, both new and old, will be supercharged for peak economy, peak output throughout the system.

Like Mid-Valley, you too stand to gain plenty with dependable, highly efficient Cooper-Bessemers. You just can't do better!

Map of Mid-Valley Pipe Line Company's 1000-mile system including new stations and station expansions.



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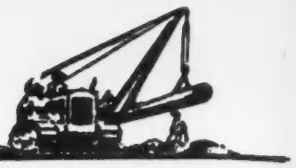
PIPE LINE *Construction*



By CECIL W. SMITH, WORLD OIL Staff

Projects Announced and Contracts Awarded

Crude Line

Service Pipe Line Company made application to the Wyoming Public Service Commission for permission to build 22.8 miles of pipe line from the North Sage Spring Creek field, Natrona County, to the company's line at the South Cole Creek field in Converse County.

Product Lines

Ecuadorian Government plans to build 45 miles of 6-inch pipe line when materials become available. The line will run from Bucay, Guayas Province, to Palmira, Chimborazo Province, and will be laid by J. A. Jones Construction Company, Charlotte, N. C. Design is being handled by C-R-C Engineering Company, Houston.

Miami Valley Corporation plans a 12-mile 8-inch product carrier to extend from its present line at Cheviot, near Cincinnati, Ohio, to the Ohio River near Sedamsville.

Standard Oil Company of Indiana has awarded a contract to Bills & Troth Construction Company, Tulsa, for the laying of 122 miles of 8-inch line from Neodesha, Kan., to Belton, Mo. Work was scheduled to get under way sometime during October.

Natural Gas Lines

Arkansas Louisiana Gas Company made application to FPC for permission to lay 16.37 miles of 8-inch pipe line from a dehydrating plant, Claiborne Parish, No. La., to a gas treating plant in Columbia County, Ark.

California-Pacific Utility Company has FPC authorization for 14.5 miles of 4-inch line to run from Pacific Gas & Electric Company's line near Topock, Ariz., to Needles, Calif.

Cumberland and Allegheny Gas Company has asked for FPC permit to lay 13 miles of pipe line in Preston and Barbour Counties, W. Va., and Allegany County, Md.

El Paso Natural Gas Company plans to build a 1980-hp compressor station near Shell Oil Company's TXL plant in Ector County, and a 11-hp station near Phillips Petroleum Company's plant in Gaines County, both in West Texas. El Paso has FPC authority for the Ector station, but does not need a permit for the other.

Home Gas Company received FPC authorization for 16 miles of loop on its existing line in Steuben and Chemung Counties, N. Y.

Houston Natural Gas Company has awarded contract for 15 miles of 14-inch line to Rhodes Construction Company, Corpus Christi, to be laid in the vicinity of Corpus Christi. The project includes a Nueces Bay crossing, and was scheduled to get started early in October.

Manufacturers Light & Heat Company has FPC permission to lay 26 miles of pipe in Fayette, Allegheny, Beaver, Somerset, Adams, Franklin, and Westmoreland Counties, Pa., and Hancock County, W. Va.

Michigan Gas Utilities Company has FPC permission to build 65.2 miles of line from Panhandle Eastern's system near Marshall, Mich., to Coldwater and Sturgis; 5 miles from Hillsdale to Jonesville and 6.5 miles from midway to Marshall-Coldwater line to Union City, all in Michigan.

Mississippi River Fuel Corporation has petitioned FPC for permission to build a 13-mile 12-inch pipe line from the Sligo gas field, Bossier Parish, No. La., to the Barksdale gunnery and bombing range.

North Penn Gas Company and **Crystal City Gas Company** has FPC authority to construct 10.3 miles of loop lines in Farmington, Fayette County, storage area.

Pacific Gas & Electric Company has received temporary authorization from FPC for 44 miles of 8-inch pipe line to run from a point south of Salinas, Monterey County, to King City, Monterey County, Calif.

Republic, Light, Heat & Power Company, Inc., has been given permission by FPC to build 9 miles of 10-inch line from the Sheridan compressor station to a point near Dunkirk, N. Y.

Union Gas & Electric Company has received temporary authorization from FPC for 33 miles of 8-inch line to be laid from Texas-Illinois Natural Gas Pipe Line Company's system in Piatt County, Ill., near Farmer City to Bloomington, Ill., and has awarded contract for the job to O. R. Burden Construction Corporation, Tulsa.

United Fuel Gas Company recently received authorization from FPC to build 45 miles of pipe line and a 2640-hp compressor station in Putnam and Kanawha counties, W. Va.

United Gas Pipe Line Company has awarded contract to Massey Pipe Line Construction Company, Corpus Christi, for the construction of 21 miles of 12-inch pipe line to run from its Bruni station, Webb County, Southwest Texas, to Aguilares, also in Webb County. Work expected to get under way during October.

Projects Starting

Crude Lines

Ohio Oil Company has started the final portion of its "big inch" crude line from Wood River, Ill., to Lima, Ohio. This section totals 117 miles and will be constructed of 22-inch pipe and will stretch from Sheridan, Ind., to Lima. Conyes Construction Company, San Pablo, Calif., is doing the work and expects to complete the leg and have it in use early in 1952. Completion of a new pumping station at Patoka, Ill., scheduled for November 1, will give the 20-inch portion of the line between Wood River and Martinsville, Ill., a capacity of 180,000 barrels per day. The 22-inch line from that paint to Lima will carry 250,000 per day.

Service Pipe Line Company has started 19 miles of 6-inch line from the South Haskell field, Haskell County, North Texas, to the newly completed Jud-Bowie 10-inch line. Gaasch Construction Company, Brownfield, Texas, has the contract. Another lateral from the same trunk line runs to the North Knox City field, Knox County, North Texas, and is to be 14 miles long and made of 6-inch pipe. Jim J. McCormick Construction Company, Wichita Falls, is doing the job, and started in September.

Service Pipe Line Company had Jim W. McCormick Construction Company start 20 miles of 6- and 8-inch line in the Levelland, Cochran County, West Texas, vicinity.

Service Pipe Line Company contracted with Smith Contracting Corporation, Ft. Worth, to lay 15 miles of 10-inch line from the Old Glory station, Stonewall County, North Texas, to the western terminal of the Jud-Bowie 10-inch line just completed. Work on this leg started in September. Thirty-nine miles of 8-inch line to connect the Cogdell station, Kent County, West Texas, with the Old Glory station is due to receive pipe from the first quarter's steel allocation in 1952.

Service Pipe Line Company is building 25 miles of 10-inch pipe line from the Denton field, Lea County, N. Mex., to the Wasson station, Yoakum County, West Texas. Crosley and Hardy Pipe Line Construction Company, Wichita Falls, started the spread during September.

Product Line

Phillips Petroleum Company during September had Somerville Construction Company, Ada., Mich., start 73 miles of 8-inch loop lines on its main trunk between Farmer City, Ill., and E. Chicago, Ind.

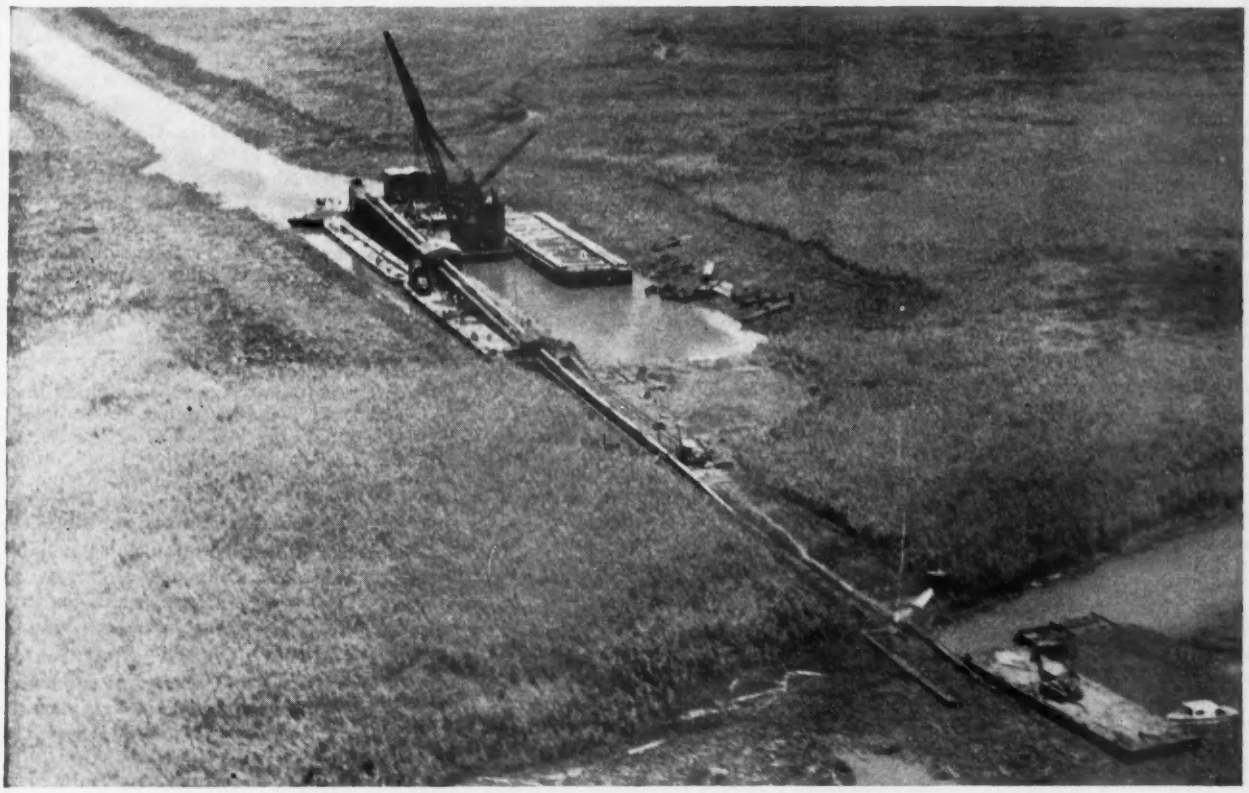
Natural Gas Lines

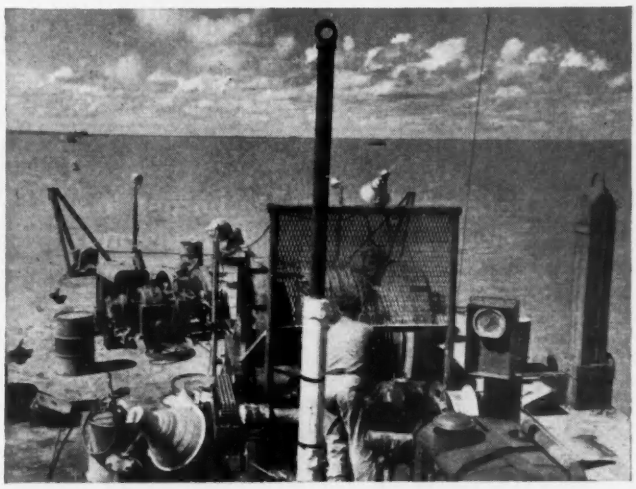
The East Ohio Gas Company started about 50 of 26-inch carrier from W. Austintown, Ohio, to Cleveland. Williams Bros. Company, Tulsa, has the contract.

Home Gas Company had Britton Contracting Company, Inc., Washington, Pa., start 20 miles of 12-inch gas pipe line looping in the Horseheads, N. Y., vicinity.

Home Gas Company started 17 miles of 12-inch loop lines during September. The loops run between Hancock, Delaware County, to a point north of Deposit, Broome County, N. Y. Britton Contracting Company, Inc., is doing the construction.

Michigan Gas Storage Company is building 78 miles of 16-, 22-, and 24-inch





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Coated with Somastic and concrete, 5 length sections of pipe were welded together on a specially designed 500 ft. ramp in 10,000 ft. sections which were towed from the ramp, laid and tied into a continuous pipe line to the well out in the Gulf.

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loops from Laingsburg Junction to Mt. Clemens and Pontiac, Mich., and a 12-mile 8-inch supply lateral. Mahoney Contracting Company, Lansing, Mich., has the contract and got the job underway during September.

New York State Natural Gas Corporation had Pipeline Construction and Drilling Company, Camp Hill, Pa., start work on 23 miles of 20-inch main line loops from N. Y.-Penn. state line to Angelica, N. Y.

Ohio Fuel Gas Company contracted with Ohio Pipe Line Constructing Company, Granville, Ohio, to lay 37 miles of 20-inch line between Benton and Carroll, Ohio. Work on this project started during September and is scheduled to be completed early in November.

Ohio Fuel Gas Company awarded a contract for the laying of 23 miles of 16- and 20-inch pipe line between Wellington, Lorain County, to Parma, Cuyahoga County, Ohio, to H. L. Gentry Construction Company, Jackson, Mich., and the job got under way early in October.

Panhandle Eastern Pipe Line Company had Z. Jack Graham, Amarillo, start work early in September on 25.6 miles of 4- through 12-inch gathering system in the Hugoton gas field, Stevens County, Kans.

Shell Pipe Line Corporation awarded contract for 25 miles of 8-inch line from Fordtran field, Victoria County, Texas Gulf Coast, to Provident City field, Lavaca County, to Anderson Bros. Corporation, Houston. Contractor started work early in October.

Tennessee Gas Transmission Company has Western Pipe Line Constructors, Inc., Austin, under way on 10.6 miles of 30-inch loop line from Dickson, Tenn., to the Harpeth River. The same contractor is also doing 20 miles of 30-inch from Richmond, Ky., to the Dix River, and 15 miles of 30-inch near Morehead, Ky.

Texas Eastern Transmission Corporation started 35 miles of 30-inch northward from the Kentucky River in Ky. This spread was started late in September by Anderson Bros. Corporation, Houston.

United Fuel Gas Company is laying 32 miles of 20-inch line between Nitro and Clendenin, W. Va. H. L. Gentry Construction Company is doing the job, and started in September.

United Gas Pipe Line Company started right-of-way work on 15 miles of 12-inch line from the South Long Mott field, Calhoun County, to East Sheriff field, Texas Gulf Coast.

United Gas Pipe Line Company had Oklahoma Contracting Company, Dallas, start 86 miles of 30-inch pipe line during the first half of October. The line will run between Refugio, South Texas, to Pierce, Wharton County, and is part of the Agua Dulce to Monroe, La., section of United's large expansion program.

Projects Completed

Crude Line

Lion Oil Company had George Tucker Pipe Line Construction Company, Odessa, Texas, at work since July on 140 miles of 6- through 30-inch gathering system in Scurry County, West Texas, and the job was completed during October.

Natural Gas Lines

Michigan Consolidated Gas Company completed 121 miles of 24-inch pipe line laid from the Austin storage field near Rodney to Farmington, Mich. Anderson Bros. Corporation were the contractors.

Pan American Gas Company completed 40 miles of 16-inch line from Winnie, Jefferson County, to Texas City, Upper Texas Coast. Anderson Bros. Corporation held the contract.

Texas Eastern Transmission Corporation had Eastern Pipe Line Contractors, Dallas, do 76 miles of 30-inch line from Tennessee River to Columbia, Tenn., and that spread was scheduled to be completed by the end of October.

Texas-Illinois Natural Gas Pipe Line Company were expected to complete 380 miles of 30-inch line between Cass County, Northeast Texas, and Cape Giradeau, Mo., during October. The Bechtel Corporation, San Francisco, was the contractor laying the line.

Texas Illinois Natural Gas Pipeline Company has completed all of its 30-inch line in Illinois. Midwestern Constructors, Inc., Tulsa, laid the 280 miles from the Ill-Mo. state line to Joliet.

West Texas Gas Company employed Brodie Construction Company, Amarillo, to lay 26.6 miles of 10-inch line from its Tahoka compressor station, Lynn County, W. Tex. to a point south of Lubbock. The project was scheduled to be completed about the end of October.

Coating field joints on barges in the swamplands of South Louisiana.
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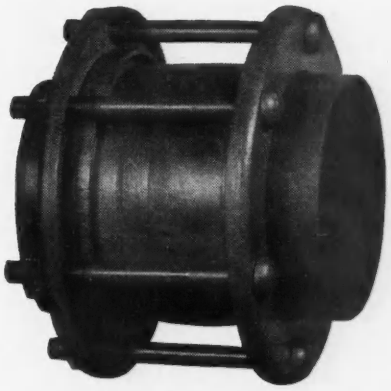
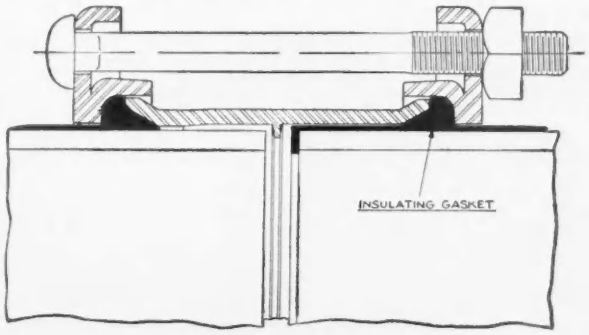
Sizes ½" through 30" and up. Also reducing sizes for going from steel to CIP.





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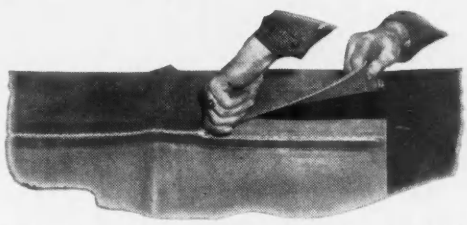

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How to do it!

PIPE LINE HINTS

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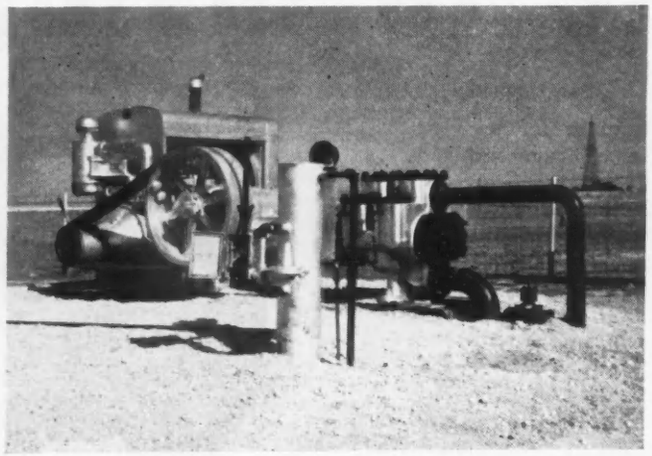
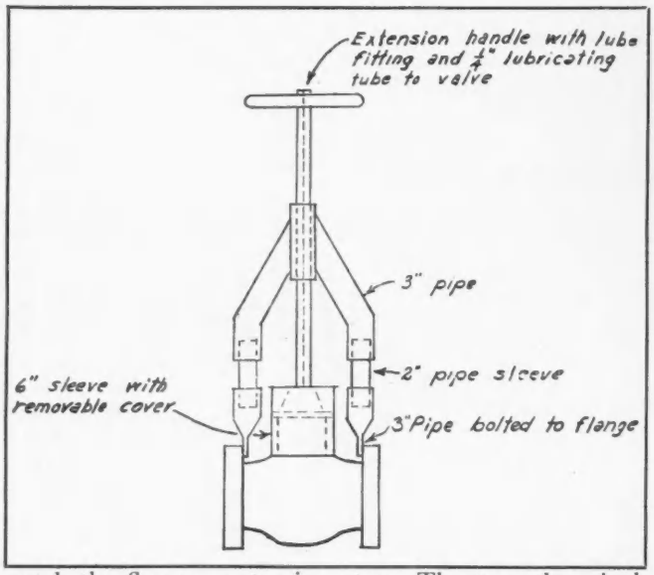
HOW TO—Rig Pump Time Shutoff



Where gas engine driven reciprocating pumps are intermittently used to boost oil pressure in pipe line gathering systems, a handy device which automatically shuts off the pump at a specific time saves employes time and travel.

The shutoff device, mounted on the volume chamber of the gas supply, is spring clock actuated. When the pumper visits the booster, to start the pump and service the unit he winds the clock mechanism and sets the running time for the pump on the dial. Later, when proper time has elapsed, the clock trips a small valve which vents pressure off the diaphragm of a control valve to shut off gas supply to the engine. Check valves prevent back flow through the pump.

HOW TO—Brace Extension Handle


Extension handle with lube fitting and ¼" lubricating tube to valve
3" pipe
2" pipe sleeve
6" sleeve with removable cover
3" Pipe bolted to flange

A brace which strengthens valve extension handles to eliminate trouble with bent extension stems and to facilitate work around the valve can be constructed for about $20 using scrap materials.

As shown, a two-part frame-work of three-inch pipe bolts to flanges on the valve. The bottom sections are short lengths of three-inch pipe with flattened ends through which holes are drilled to match the flange holes.

Upper section of the framework is made of three-inch pipe mitred onto a sleeve which fits around the valve extension stem. The two three-inch sections are joined by inner sleeves of two-inch pipe.

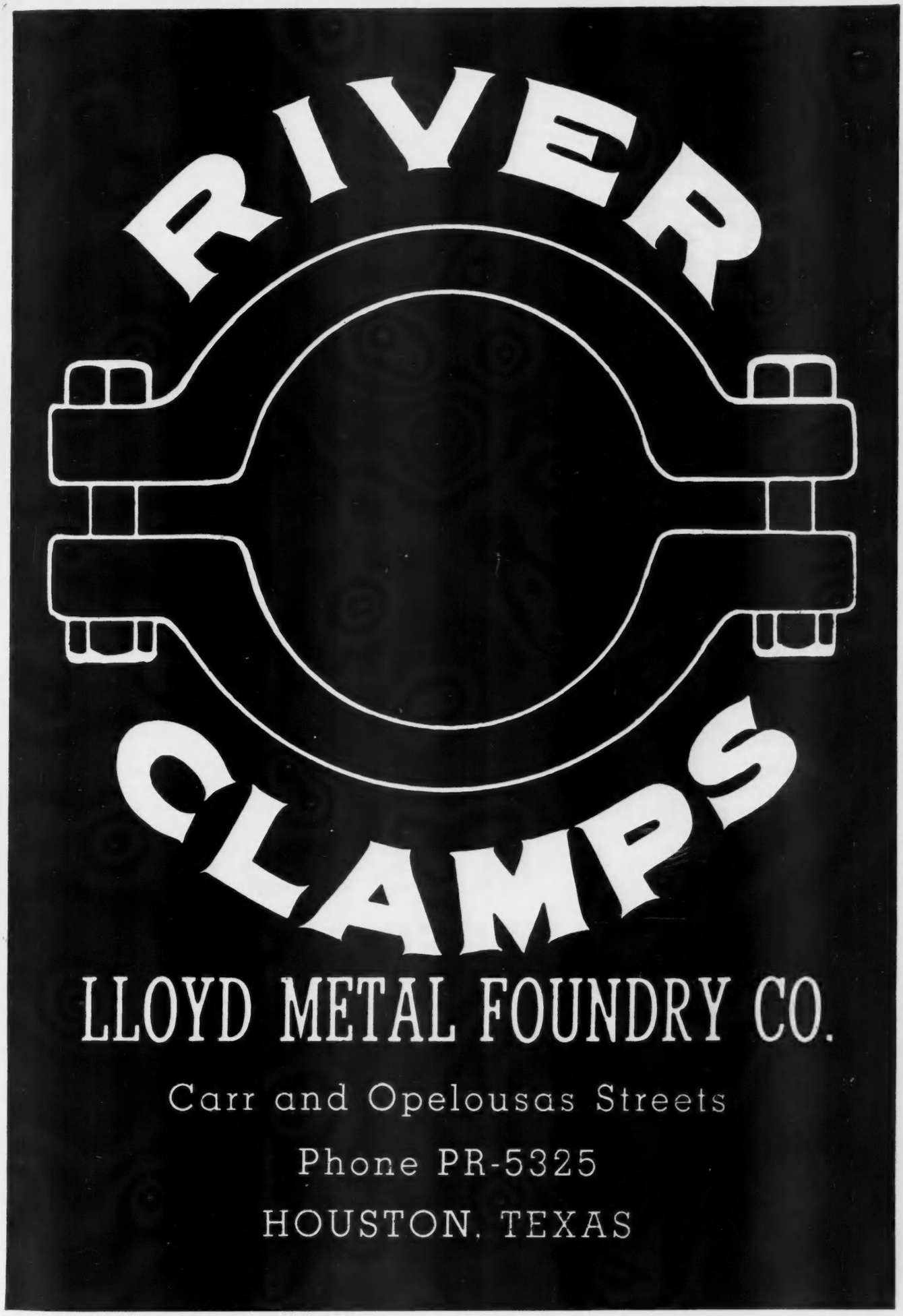
The added strength of the installation permits use of machinery in uncovering buried valves, and added rigidity makes the above ground installation more free from vibrations.

HOW TO—Add Tanks, Boxes to Mechanic's Pickup

A mechanic who has several pipe line stations to look after will find it convenient to have his pickup truck equipped with a tool box together with tanks and spigots for solvent and gasoline. The liquid containers are built across the bottom of the tool box in the excess space where tools would be hard to reach. Filler connections are placed conveniently inside the edge of the box.

After the two tanks are assembled and welded together, the sides are extended upwards to form the tool box. A sliding tray for hand tools is placed on runners across the top of the box, so that the tools are available from either side of the truck. When the tray is slid to one side, the lower section above the false bottom for the tanks is available for larger tools.

Spigots on the side of the pickup (see arrow) make the liquids handy for whatever use may be made of them.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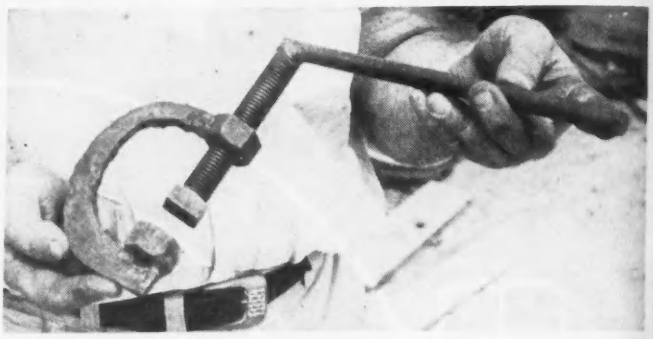
TRANSPARENT
Drop Forged Steel
Liquid Level
GAGES

Glass front and rear permits observation of color and density of liquids under high pressures and/or temperatures. Highest quality—made of temperature resisting alloy steel. Conforms with API and ASME requirements.

3277-C

PENBERTHY INJECTOR CO.
Detroit 2, Mich.
Canadian Plant—Windsor, Ontario

HOW TO—Make "C" Clamp in Shop



A "C" clamp can be inexpensively and easily made using one stud, two hex nuts and scrap plate.

A "C" section is cut from scrap steel and welded to the two hex nuts as shown. The stud is threaded through the upper hex nut and a square nut made up and welded to one end, to serve as a bearing surface for the clamp.

A handle of convenient length is cut from round steel rod and welded to the hex nut.

While this is not an ideal "C" clamp, it can be made in a few minutes and it will serve its purpose if manufactured clamps are not available.

HOW TO—Speed Closing of Valves

Spinner knobs of the type found on farm tractors can speed operation of low pressure valves in a tank farm.

The knobs, which can be purchased at any farm tractor supply store for about 75 cents, can be easily mounted on the wheel of valve. After the gate in the valve is broken loose and pressure equalized, the spinner knob can be used to quickly open or close the valve. This speed of operation greatly aids in batching operations.

MISSOURI DREDGING CO.

Phone: FRANKLIN 5764

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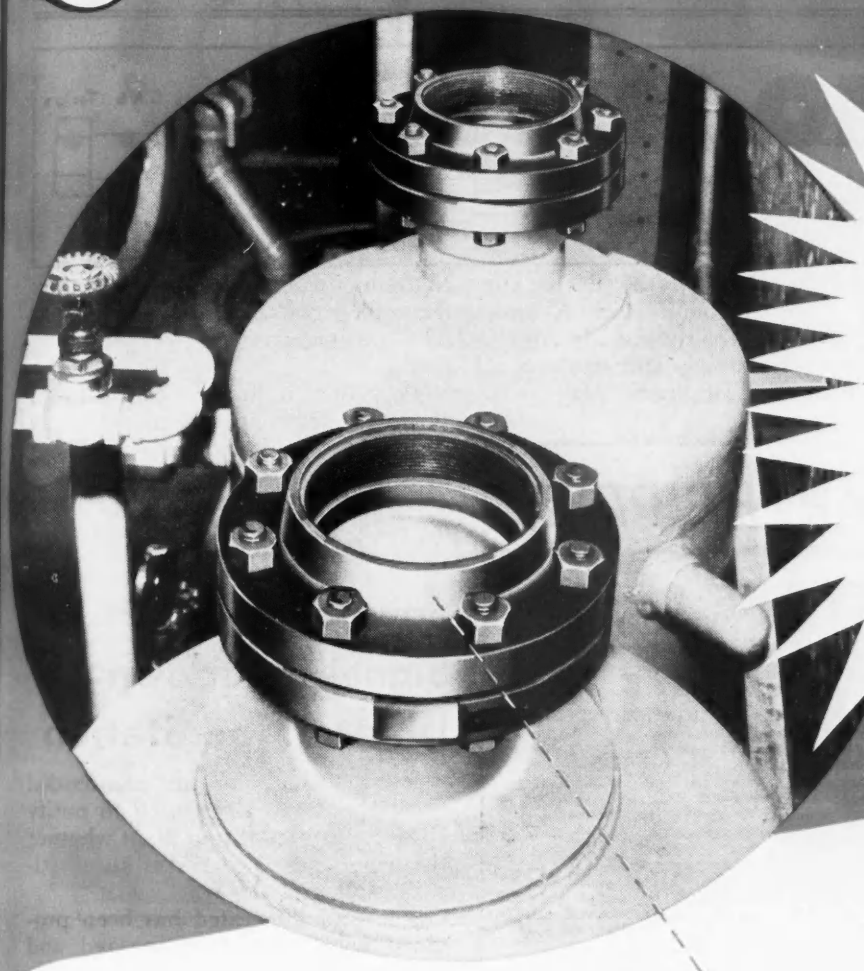
HYDRAULIC DREDGING
RIVER CONSTRUCTION

☆

PIPELINE AND CABLE RIVER CROSSINGS

18-INCH SUCTION DREDGE

Like a Fuse for Electric Power Load . . .



SAFETY HEADS *for* PRESSURE LOAD

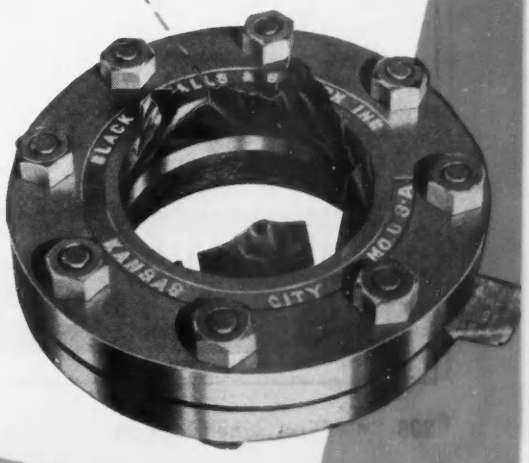
It would be hard to conceive of an electric power application without fuses to afford relief in case of overload. When the fuse element ruptures it breaks the circuit—to save the line and equipment and prevent fire.

When the load is pressure of gas or liquids—BS&B Safety Heads give that same instant, full, pipe-sized relief in the same simple, positive manner by the rupture of a disc. Super-accurate pressure "fuses," Safety Heads will rupture within ± 5% of the pre-determined pressure. Discs are available within a range of 5 lbs. to 40,000 lbs. The resulting opening is unrestricted—as complete as the break in a fuse. No other pressure relief device acts as fast to prevent damage to equipment, property or personnel.

Safety Head action is positive because there are no moving parts to break or to wear out, become fouled or fused at critical moments or prove inadequate to relieve a sudden excessive pressure surge

Whether your pressure applications are for air, gas or liquids—bland or corrosive—BS&B is equipped to provide Safety Heads for them, with pre-tested discs of the proper metal element, designed to rupture at the pre-determined pressure and temperature specified for safety. Used as primary relief devices or to protect or supplement relief valves, BS&B Safety Heads are accurate, code-accepted for your pressure lines or vessels.

Write today *for free catalog and complete details. There is no charge for a complete analysis of your pressure problem by the BS&B laboratory and engineering staff.*



BLACK, SIVALLS & BRYSON, INC.

Dept. 34-B 7502 East 12th St.
Kansas City 3, Missouri

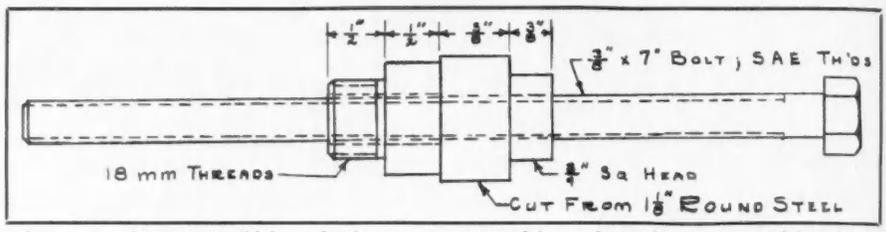
SAFETY BS&B HEADS

HOW TO—

Make Head Puller For L-Head Engines

A simple head puller that can be fabricated for about $2 can be used to remove "frozen" heads on L-head engines without damage.

For all engines using 18 millimeter spark plugs, a three-eighths-inch machine bolt serves as jack screw, when attached to a lifting device cut from 1⅛-inch round steel. A two-inch long piece of the steel is tapped for the bolt threads and one end is milled to size of spark plug hole. Matching threads are machined on the milled end to permit the lifting device to be screwed into spark plug holes.



To remove a "frozen" engine head, the lifting device is screwed into spark plug holes, and the jack bolt advanced to seat firmly on the valves. Using four or six of the lifters, tension on each bolt is advanced until the engine head comes loose.

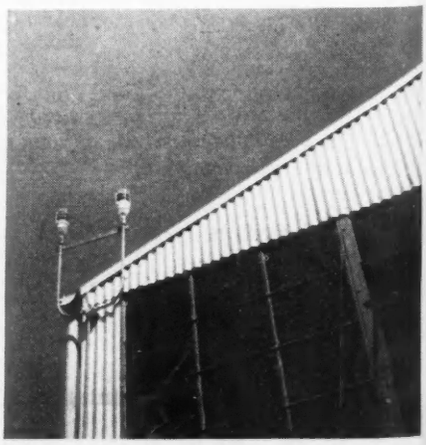
HOW TO—

Signal Shutdown at Unattended Station

Signal devices at an unattended booster station can be used to notify an operator at a distant plant whether the unit is operating or is automatically shut down.

The unit illustrated has been provided with two lights, one red and one green, on the roof of the unattended building. The station has the necessary safety devices for shutdown in case of an excessive oil flow rate, a sudden drop in oil supply, or an excessive jacket water temperature.

The instruments operating the lights are conventional switches which hold the green lamp circuit closed while the unit is operating according to plan, and open this circuit while closing the red lamp circuit when the unit is shut down. The station is visible from an attended plant, where the operator frequently looks toward the signal lights to determine the status of the unit.



PEWTHERS' *"EARTHRIPPER"*

OPENS THE EARTH LIKE A ZIPPER!

ECONOMICAL... Pewthers' EARTHRIPPER saves money three ways! It costs less—it's speedy operation saves labor costs . . . and standardization of automotive parts cuts down maintenance costs. Construction engineers who use the Pewthers' EARTHRIPPER have found that it costs only 4c a foot to operate. This low cost covers initial investment, depreciation, operation, maintenance, and labor over a three-year period! With an EARTHRIPPER, one man can handle your ditching problems, from driving the machine to the ditch site to lowering the boom and opening the earth at a maximum rate of twenty feet a minute! Because all gears run in oil, the EARTHRIPPER can be used for years with few replacements of parts. If you want to save time and money, invest in an EARTHRIPPER today.

MOBILE... The EARTHRIPPER is versatile because it is mobile. On the highway its speed is the speed of the truck. The raised boom clears telephone wires and tree branches, making transit easy and speedy, even in heavy city traffic. The EARTHRIPPER digs vertical ditches in any kind of terrain under almost any digging conditions. On slopes the frame levels. While the tires follow the contour of the earth, the ditcher digs a vertical ditch! If you need a ditcher for large or small ditching jobs, the EARTHRIPPER can solve your problems.

EFFICIENT... For straight, clean ditching, the answer is Pewthers' EARTHRIPPER. This new, unique ditcher offers a completely different design. It is the first ditcher to be built into a truck. Bucket design saves time because there is no loss of time in cleaning. Bottom of each bucket forms the top of the preceding one. The buckets separate as they go over the top sprocket, throwing the dirt onto the conveyor belt. Conveyor belts throw the dirt on either side of the ditch and can be reversed on a moment's notice. In competition the EARTHRIPPER digs straight ditches with clean sides . . . in record time.

Send for the folder on the new Pewthers' ditcher, the EARTHRIPPER. Learn for yourself how the EARTHRIPPER can save time and money on any small ditching job! Ask for a demonstration before purchase . . . at any point in the United States!

Pewthers' "EARTHRIPPER" is the only ditcher built into a truck. This means *one man* can handle your ditching job, from driving the machine to the ditch site to opening the earth to a maximum depth of five feet. The EARTHRIPPER is particularly suited for gas lines, extensions and house-to-street service lines. Utility ditching requiring ditches 10", 14", or 18" wide are duck soup to this new, *different* Pewthers' ditcher.

I want the new folder on the Pewthers' "EARTHRIPPER."

NAME_____ TITLE_____

COMPANY_____

ADDRESS_____

I saw this ad in the above magazine.

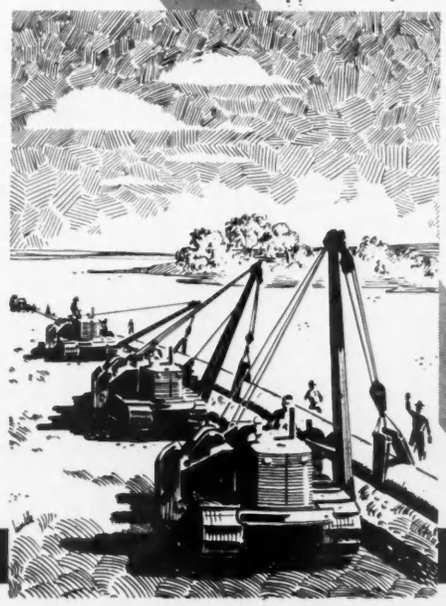
PEWTHERS DITCHER COMPANY

3530 MANSFIELD ROAD • SHREVEPORT, LOUISIANA

. . . . . WE OFFER

EXPERIENCED MEN...
EXTENSIVE EQUIPMENT...
AVAILABLE FOR YOUR
PIPE LINE CONSTRUCTION—ANYWHERE

Sheehan has the men with the experience, the skill, the up-to-date equipment to do a better pipe line construction job for you. Call us in on your next job.



SHEEHAN

SHEEHAN PIPE LINE CONSTRUCTION CO. TULSA OKLA.

John B. Sheehan, Gen. Mgr. • Robert D. Sheehan, Supt. • James H. Nolan, Supt.

Corrosion Men...

with the right materials to solve your problems.

Men who have spent years in corrosion research and the development of corrosion prevention products are here to help you in the solution of your problems.

In addition to stocks of these proved corrosion prevention products at Houston, prompt shipments in any quantity are assured by the strategic location of the manufacturers' plants and warehouses.

James E. Mavor Company service follows through from order to delivery.

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Hot Applied Pipe Line Coatings
Manufactured at: Houston, Texas Woodward, Ala.; East St. Louis, Ill.; Chicago, Ill.; Follansbee, West Va.; Garwood, N. J.

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Stocked at Houston for immediate shipment

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Asbestos Pipe Line Felt
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PIPE WRAP
holds larger quantities of enamel on pipe . . . is not subject to deterioration thereby providing longer life for protective coating.

JAMES E. MAVOR COMPANY

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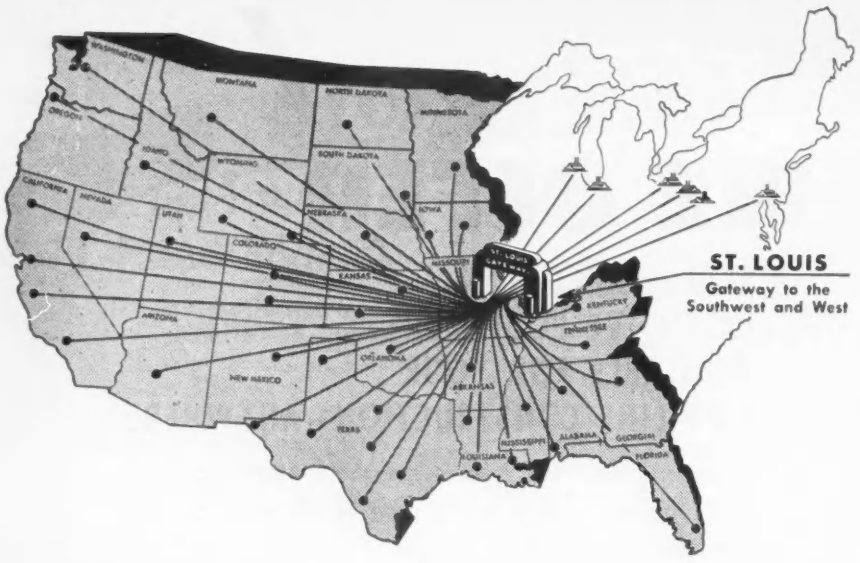
T. F. P. KELLY
HOUSTON 2, TEXAS



Minimum *Through* Freight Rates with "In-Transit Privileges" at St. Louis

standard pipeprotection, inc. . . . offers two outstanding advantages to purchasers of pipe

1 When you ship through the St. Louis gateway you use "through freight rates" instead of the higher combination rates generally used. This in-transit privilege permits stop-off for processing or storage at St. Louis without freight penalty

2 Your pipe is cleaned, coated and wrapped to your own specifications by modern streamlined methods. Our plant and facilities (covering 22 acres) represent the last word in pipe handling equipment. The techniques used are the best practices that have been developed through experience by the industry.

From start to finish, the manufacturing process is controlled by standard procedures. This guarantees new standards of protection — new records in performance — important considerations these days to every buyer of pipe.

standard pipeprotection inc.

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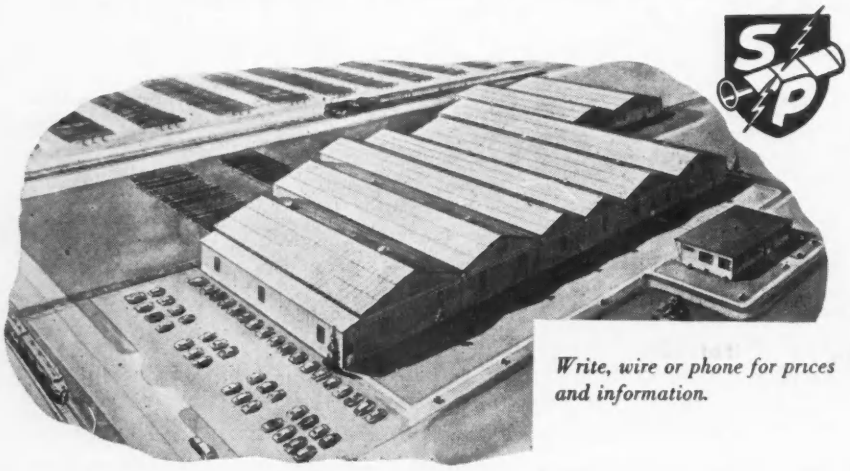
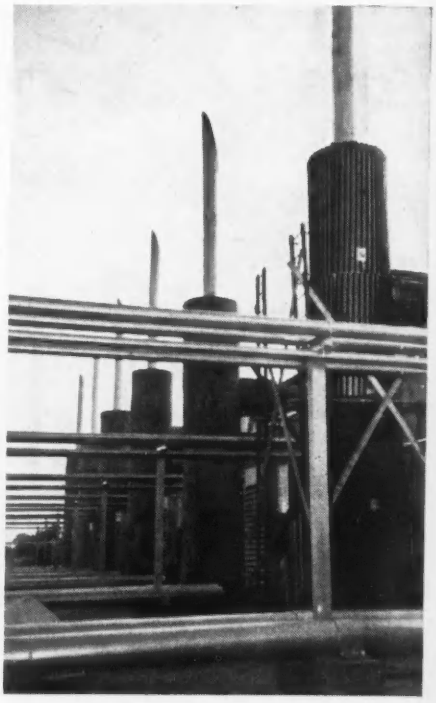


Write, wire or phone for prices and information.

HOW TO—

Minimize Noise at Compressor Station

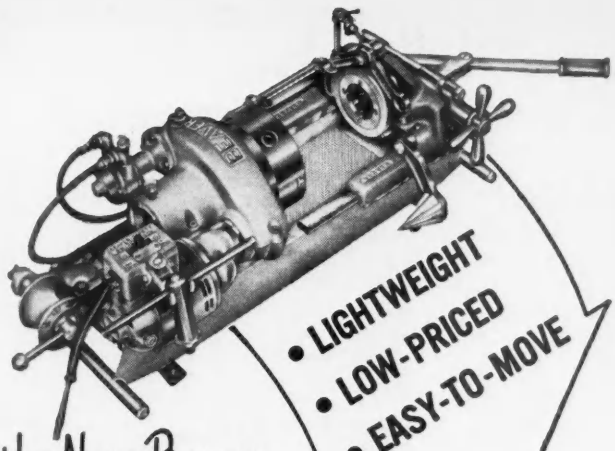


Compressor station noise can be minimized in thickly populated localities by increasing silencer cells, snubbing air intake and insulating silencers with a thick coat of rock wool and other insulation.

When one company was faced with irate landowners who complained of the noise made by a compressor station, the company first snubbed engine air intake and added a "hospital" cell to existing silencers. Still the noise level brought complaints. The company then added a heavy coat of insulation to silencers and exhaust lines and noise dropped to such a low level that neighboring landowners were satisfied.

The insulation was applied in the following manner. First, a high ribbed metal lath was wired around the silencer to provide air space next to the metal surface. Second, four inches of rock wool was wrapped around the silencer and held with 16 gauge galvanized wire. Third, a wet coat of insulating asbestos plaster was applied to the metal lath and finished with a weather seal.

Elimination of burn-hazard to employes is an additional value afforded by the insulation.



• LIGHTWEIGHT
• LOW-PRICED
• EASY-TO-MOVE

the New Beaver Model-E Pipe and Bolt Machine

The new low-priced, lightweight Beaver Model "E" is a "junior edition" of the heavy-duty Beaver Model A—which has, for the past 20 years, been the recognized leader in the field of portable pipe and bolt machines.

Although designed primarily for hardware stores and small piping contractors and industrialists, BIG contractors will find the new Model "E" useful on jobs requiring extreme portability.

A pipe machine is no better than the service back of it and our 50 years of experience in this field, and our reputation for high quality and friendly service, is your best guarantee of complete satisfaction.

Price—$385.00. Write for new bulletin—"14 Outstanding Advantages"

BEAVER PIPE TOOLS

254-300 DANA AVENUE • WARREN, OHIO, U. S. A.

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Right in the heart of town

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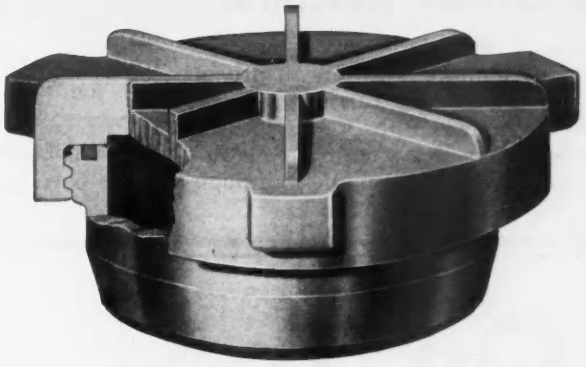
GREATER SECURITY MORE CONVENIENT



Yale 2-Piece Blank Cap Unions for the Pipe Line Industry

Universal acceptance of Yale's modern 2-piece design is proof of the advantages it offers; new lines everywhere are using these lighter, safer, more convenient unions on scraper traps, strainers and jumper assemblies.

With Yale Blank Cap Unions, the conventional "third" piece is eliminated. There are no loose rings or bolts, no hammering is required, there's no continual replacement of damaged or lost parts. A positive seal against pressure or vacuum is provided by oil and gas-resistant "O"-Rings.

Yale 2-Piece Blank Cap Unions are furnished in sizes from 2" through 36", with or without hinges, for working pressures to 1500 psi. Full information will be furnished upon request.

YALE
MACHINE WORKS
Telephone ME-4282 - P. O. Box 10117
HOUSTON 7, TEXAS
EXPORT: R. S. STOKVIS & SONS CO., NEW YORK, N. Y.

HOW TO—

Polish Floors With Air-Driven Machine

Waxed concrete floors can be kept in good condition with an air-driven polisher that can be carried easily by one man anywhere the tool is needed.

The motor is a conventional air-operated unit. Air is supplied through a long hose which permits the unit to be used anywhere. The throttle is a small globe valve attached to the pipe handle of the machine. The polishing brush is a wood-backed unit reinforced with a circular steel plate. Speed of rotation can be controlled by the throttle valve to bring out the high gloss desired by the operator.

The light weight makes the polisher easily portable. Another advantage is its safety factor, since no spark is possible, even if the rotating head should strike a metal surface.

On Top IN OUR FIELD

Nueces, San Patricio and Karnes Counties—all in South Texas—produced approximately 3,163,798 barrels of crude in July, 1951.

Of this volume these companies produced, purchased and pipelined 1,305,156 barrels, or 41 per cent of the total.

It was gathered, transported, terminaled and marketed through our own facilities, a fact which demonstrates our leadership in the fields where we operate.

SOMICO

Southern Minerals Corporation
Southern Pipe Line Corporation

411 North Broadway **Corpus Christi**

HOW TO—

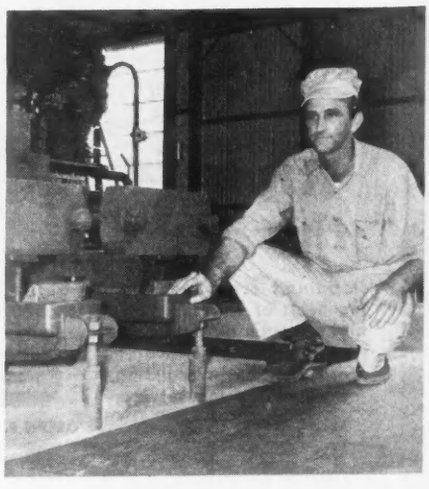
Provide Support for Pump Guide Bracket

The support illustrated prevents vertical movement in the cross-head guide for a high pressure pump.

The support is anchored in the pump block and is threaded so that the guide can be held steady without any strain being imposed. It is important to note that two bolts are provided, one above and one below the bracket fastened to the end of the guide.

Support for the cross-head guide at the other end of the plunger is provided for by the gear box connecting the pump to the prime mover.

Advantages obtained by a support of this type are longer life for the packing and less over-all wear on the pump.



Now under construction
Section No. 6
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Texas Eastern Transmission Corp.

This 30" natural gas line will extend 80 miles northeasterly from Campbellsville, Kentucky, to Boonesboro, Kentucky.

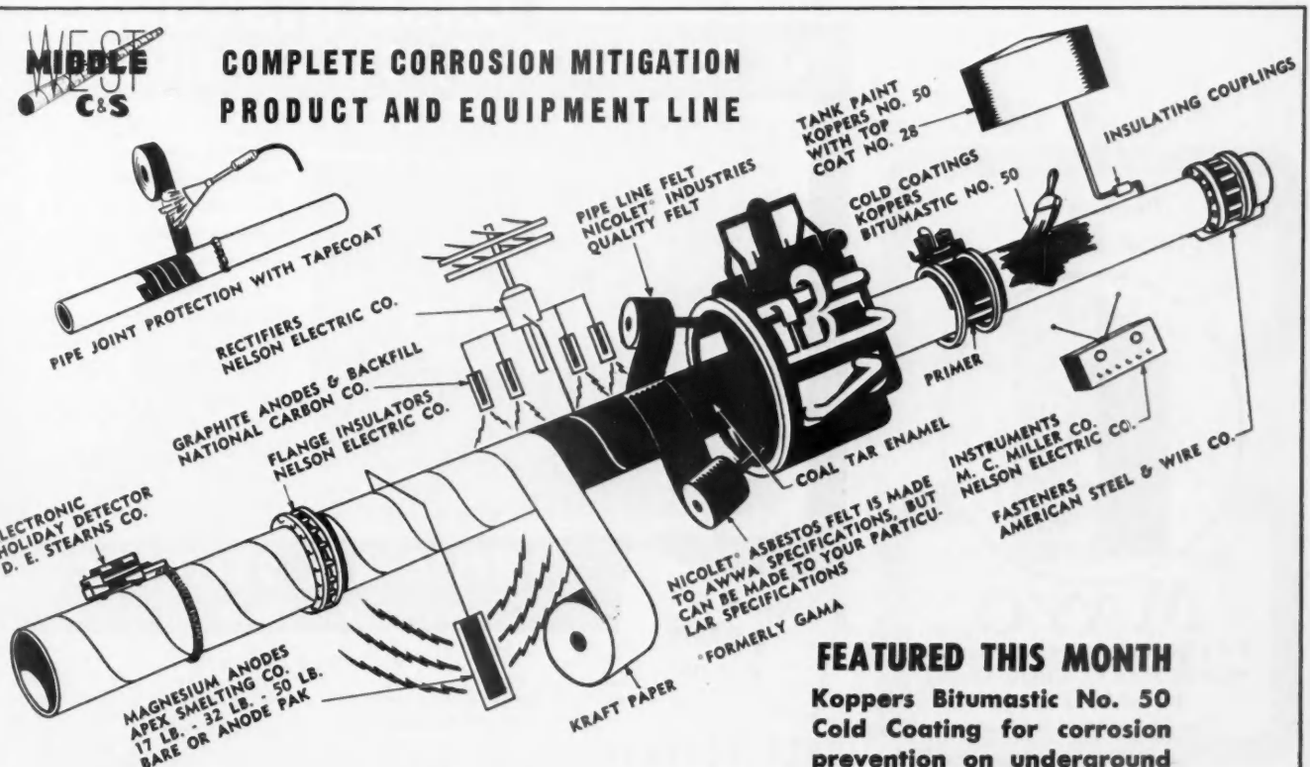
N. A. SAIGH COMPANY, INC.

531 Majestic Bldg. • San Antonio 5, Texas

Pipe Line Engineers and Contractors for 30 Years

MIDDLE WEST C&S

COMPLETE CORROSION MITIGATION PRODUCT AND EQUIPMENT LINE


TANK PAINT KOPPERS NO. 50 WITH TOP COAT NO. 28
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PIPE LINE FELT NICOLET* INDUSTRIES QUALITY FELT
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RECTIFIERS NELSON ELECTRIC CO.
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COAL TAR ENAMEL
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NICOLET* ASBESTOS FELT IS MADE TO AWWA SPECIFICATIONS, BUT CAN BE MADE TO YOUR PARTICULAR SPECIFICATIONS
*FORMERLY GAMA
MAGNESIUM ANODES APEX SMELTING CO. 17 LB. - 32 LB. - 50 LB. BARE OR ANODE PAK
KRAFT PAPER

FEATURED THIS MONTH

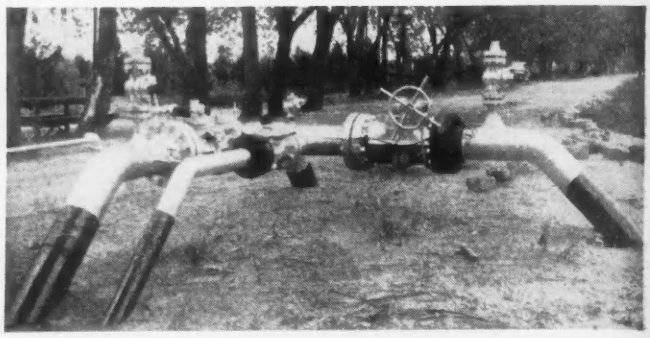
Koppers Bitumastic No. 50 Cold Coating for corrosion prevention on underground pipe. The maintenance coating. Brush application at low cost. Specified by major pipe line companies

We Invite Your Immediate Inquiry . . . Call . . . Write . . . Wire

MIDDLE WEST COATING & SUPPLY

207-A Daniel Bldg. P. O. Box 153 — TULSA, OKLAHOMA — Telephone 2-5215 or 2-5216

HOW TO—Mark Insulating Flanges



Painting cathodic insulating flanges colors distinguishing them from other flanges minimizes the mistakes sometimes made in installing or reassembling insulating bolts, washers and gaskets.

Sections of buried pipe lines which are cathodically protected must be insulated from lateral lines or segments of the line which require no protection. This is achieved by installing insulating gaskets, bolts and washers in ordinary flanges. If the flanges which are to be insulated are not pinpointed costly mistakes can be made: protection may be diverted to the wrong line; inadequate protection for the entire system may result; unnecessary amounts of currents may be required for protection.

One way to insure that the insulating materials are installed at the proper point is to have the insulating flanges marked by the corrosion engineers and painted a distinguishing color. This reduces the possibility of repair men making mistakes when reassembling pipe after repairs.

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PIPE LINE
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Personal Supervision on
Construction of Your

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★Air Conditioned ★Adj. Garage
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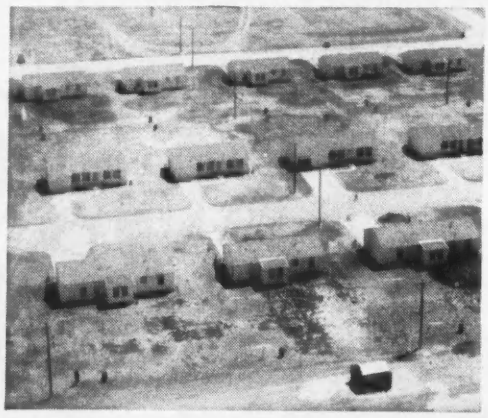
CASE HISTORIES
of Houston Ready-Cut Installations



The Pure Oil Co.'s Dollarhide Gasoline Plant Camp Site — Eighteen units were completed within specified contracted time, with materials delivered to site on schedule. Erection was done by Liberty Builders crews, an affiliate of Houston Ready-Cut House Co. Homes are attractive, livable and were completed turnkey, quickly, efficiently and at a sensible cost.

IMMEDIATE DELIVERY
anywhere in the world

What are YOUR Needs?

★ 1 HOUSE OR 100
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★ ERECTED COMPLETE OR FOR ERECTION BY YOUR CREWS

FREE SURVEY - phone or wire for a personal survey and estimate *without obligation.*

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Prefabricated Housing for Industry Since 1917
P. O. BOX 124 HOUSTON 1, TEXAS

International Section

DON KLIEWER, SECTION EDITOR

WORLD OIL

Are you Discarding Salvageable Drill Pipe?

In these days of drill pipe shortages, it may pay you to take a second and third look before discarding your pipe.

Many operators are now making hole with pipe reclaimed from castoff strings through the use of HUGHES Flash-Weld Tool Joints. These joints eliminate threaded pipe connections and make it possible to incorporate many different types of pipe in a single string. As a result, drill pipe that otherwise would not be used, is now being salvaged.

Regardless of pipe end design, any good drill pipe—with sufficient upset—can be converted into a uniform, dependable drill stem by using HUGHES Flash-Weld Joints.

Ask your HUGHES representative about the cost of unitizing your drill pipe remnants with HUGHES Flash-Weld Tool Joints, the tool joints with the proven performance record!

Watching a man with an "M. D." degree

You can always depend on...

No university awards this "M. D." degree: the men of the oil country have given the title of "Mud Doctor" to the Baroid service engineer, because his tests and recommendations help to maintain fast, trouble-free drilling.

That "Mud Doctor" title is not just a flight of fancy. As drilling muds grow more and more complex, drillers and operators realize that drilling mud is a full-time proposition — a job for a specialist. So they call in the Baroid man to make tests, to recommend and to prescribe. His recommendations on mud are followed, probably more closely than you follow your own doctor's advice, because these experienced oil operators have found that it pays off in lower mud costs, faster drilling and safer operations. If you are not making use of the "Mud Doctor", why not call him now.

Baroid

BAROID SALES DIVISION
NATIONAL LEAD COMPANY
LOS ANGELES 12 · TULSA 3 · HOUSTON 2

COMPLETE DRILLING MUD SERVICE

Unloading 30- and 32-inch pipe in the denesting yard at Homs.

Loading the pipe onto a conveyor at the denesting yard.

Pipe Line to Banias

THE Land of the Old Testament is going modern in an even bigger way. The Iraq Petroleum Company is constructing a 30-inch oil pipe line from Kirkuk, Iraq, to Banias, Lebanon, in Syria.

Capacity of the line will be 98,800,000 barrels a year. The 560-mile line will follow the alignment of existing 12- and 16-inch lines from Kirkuk to Mile 494 in western Syria, where it will branch northward to Banias, on the Mediterranean coastal plain.

Eastern portion of the line, from Kirkuk to Homs Gap, will consist of 30-inch or 32-inch pipe ordered in approximately equal proportions to permit nesting for shipment. The remainder of the pipe line on the downward gradients from the Homs Gap saddle to the terminal at Banias will consist of 26-inch pipe.

First shipments of the pipe were made in October and November of 1950. Work on right-of-way clearance and road construction began in September, 1950, ditching in October, and stringing and welding in November.

Erecting temporary houses for the construction staff.

A general view of the company depot at Homs.

Cleaning a 30-inch pipe bevel ready for welding.

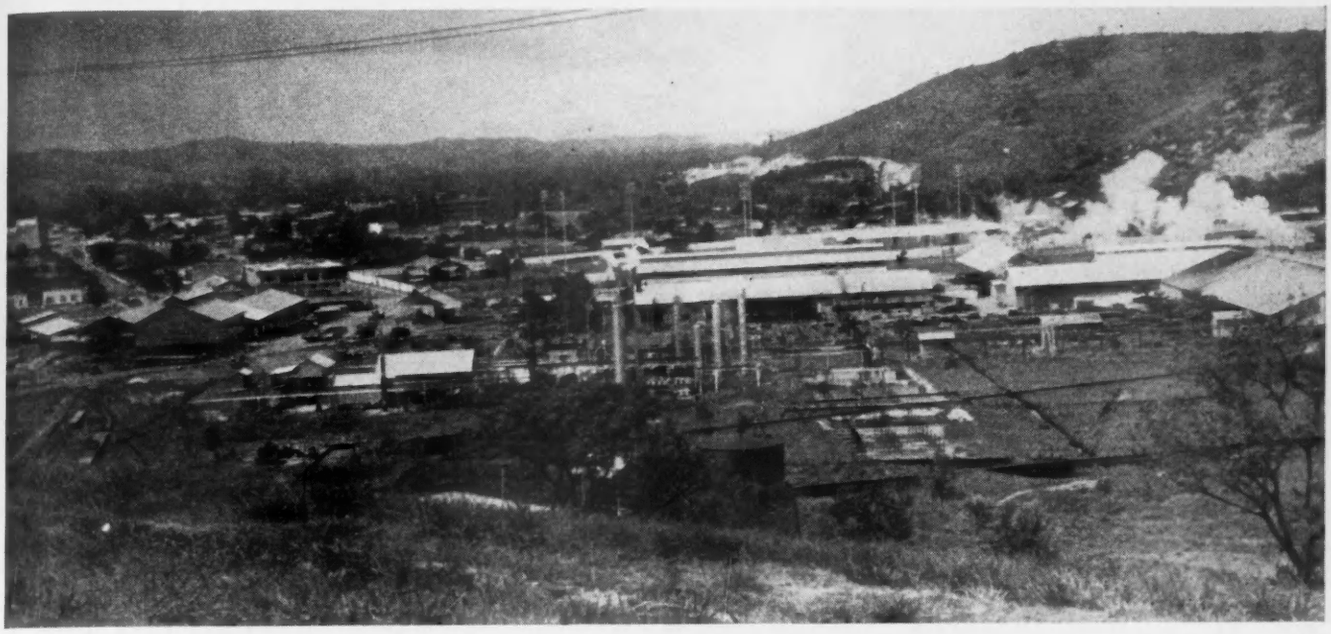
Lining up pipe for welding in the Homs yard.

Welder joins two sections of the 30-inch pipe.

Loading welding machines.

Stringing 26-inch pipe across the Beka'a Plain in Western Syria.

Making a stringer bead weld on the 26-inch pipe.



General view of Poza Rica's industrial area.

Pemex Views Future With Optimism

By E. E. BARBERII
University of Tulsa

PETROLEOS MEXICANOS is looking six years ahead to daily crude production of a half-million barrels and exports of 120,000 - 160,000 barrels. E. E. Barberii of the University of Tulsa, who has returned from a three-month visit in Mexico, analyses the Pemex organization, which today is about a quarter million barrels shy of its daily production objective and which is exporting 80,000 barrels of crude and refined products a day.

CURRENTLY producing 227,000 barrels of oil daily, Petroleos Mexicanos figures it is on the threshold of an increase to a quarter million barrels. With an estimated oil reserve of 1400 million barrels and gas reserve of 17 million Mmcf, Pemex anticipates an output of 500,000 barrels daily in six years.

With the domestic crude products demand pushed sharply upward by growing industrialization, Mexican government and industrialists are striving to lure into their economy more foreign capital, including tourist dollars.

Hand in hand with the products demand rise is the country's current daily requirements of gasoline, gas and other crude products.

Mexico's present refining capacity is 198,350 barrels a day, distributed as shown in Table 1.

Ever mindful of its foreign markets, Pemex is exporting 80,000 barrels of crude and refined products daily, with an eye toward raising that figure to 120,000-160,000 barrels a day within six years. Thus, any daily crude production gains will be automatically considered for export because it is upon export trade revenues that hinges much of Mexico's ability to get heavy equipment from abroad.

Table 1

REFINERY	Capacity, Bbls.
Ciudad Madero	65,000
Arbol Grande	19,000
Mata Redonda	12,750
Minatitlan	20,500
Atzcapotzalco	47,000
Poza Rica	3,500
Reynosa	3,600
Salamanca	27,000
Total	198,350

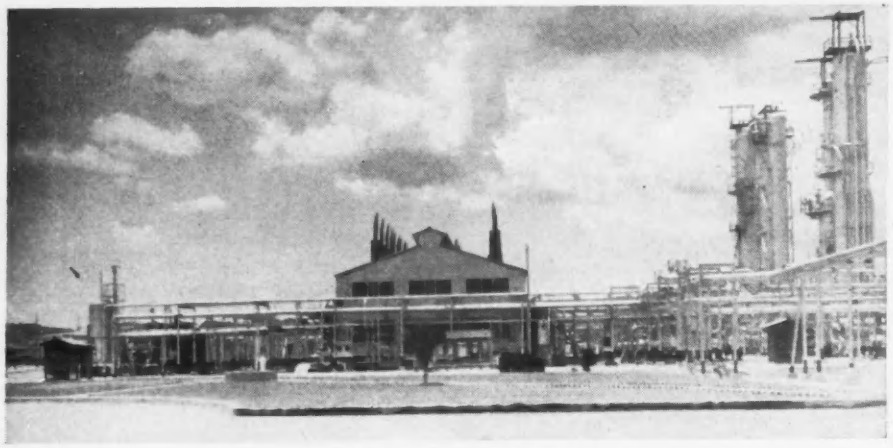
With some vessels on order from European shipbuilders, Mexico now operates an oil fleet of 18 tankers and three smaller vessels whose total capacity is 1,365,000 barrels. Coastal and river operations are handled by auxiliary vessels such as tugboats, barges, etc.

Poza Rica

Poza Rica, the nation's No. 1 field, figures prominently in Pemex' master program. The field now produces 155,500 barrels daily. Geographically, it is divided into four principal sectors:

- Poza Rica, with a daily production average of 106,000 barrels.
- Mecatepec area to the northwest of Poza Rica, which contributes 25,500 barrels.
- Escolin, south of Poza Rica, with a yield of 22,000 barrels.
- Presidente Aleman, southeast of Escolin, with an average daily output of 2000 barrels.

New production developed by Pe-



Gas absorption plant and auxiliary facilities at Poza Rica.

mex in Mecatepec, Escolin and Presidente Aleman sectors is credited for the production rise in the field at large, which is 10.5 miles long and three miles across at its widest point.

The Poza Rica producing horizon, the Tamabra limestone of Middle Cretaceous, is found at 6400 below sea level in the Poza Rica area and somewhere between 8000 and 8200 feet in the Presidente Aleman sector. The average thickness of the Tamabra is 650 feet and the oil section is calculated to be 480 feet. It has been estimated that there exists a 97-foot gas cap, and the true levels of the water zone have not been precisely determined. This has created diverse opinions as to the degree of effectiveness of the water drive. However, Pemex has made exhaustive studies of these problems, and the initiation of gas and water injection is in the trial stage. Gas injection at the rate of 8 million cubic feet per day, at 2250 pounds per square inch, has been effected. And the water injection program, using one input well, was initiated at a rate of 400 barrels per day at 100 psi.

Of a total of 152 completions, 100 wells are responsible for the present production. Average daily production is about 1500 barrels per well. Poza Rica 77, the best well of the sector, close to the Mecatepec area, makes 8000 barrels per day through a perforated section which covers only 6.5 feet. Field bottom hole pressures have been recorded at 2500 psi at 6900 feet, subsea.

The approximate daily movement of crude from Poza Rica to the refineries and ports of exportation is as follows: To Tampico, 45,000 barrels; to Atzcapotzalco, 40,000 barrels plus 8000 barrels of casinghead gasoline; to Salamanca, 18,000-23,000 barrels; and to Tuxpan, 30,000 barrels.

Fourteen development wells are now being drilled in the Poza Rica area—2 in Mecatepec, 7 in Poza Rica, 1 in Escolin, and 4 in Presidente Aleman. A semi-exploratory well, Poza Rica No. 110, to the south of the field, is ready to be spudded.

Current production in the southern zone amounts to 22,000 barrels daily. And greater increases in production are expected once full development gets underway at Jose Colomo, Fortuna Nacional and Rabon Grande.

El Plan

El Plan field, the greatest contributor to the zone's production, is yielding 14,800 barrels daily. It was discovered in 1931, when production was found in the Cedral, Lignitico and Filisola formations, all of Miocene age.

Depth of production varies from about 1800 to 2100 feet, and it is estimated that the total production thickness of these sections amounts to 216 feet. The proved area covers 839 acres, and the daily production is divided as follows: Cedral and Lignitico, 5100 barrels, and Filisola 2250 barrels. The average gravity of the crude is 24 degrees API. Forty-four wells produce from the Cedral-Lignitico and 11 from Filisola. Oil production from these formations reached 59,197,851 barrels in 1950.

Present daily production from the Lower Concepcion sand amounts to 7200 barrels from 43 wells. The area covers 606 acres and the estimated production thickness of the reservoir is 131 feet.

In 1945, Pemex found another new producing horizon at 5426 feet. This new sand, which has been named El Encanto, has a proved area of 250 acres. The reservoir thickness is only 36 feet, and only four wells are responsible for the daily production of 250 barrels of 35-gravity crude. Through 1950 the cumulative production from El Encanto reached 66,500 barrels.

El Plan oil production is divided into paraffinic and non-paraffinic. Of the first type, 11,750 barrels daily are produced from 65 wells. Thirty-eight wells yield 3050 barrels of non-paraffinic oil. Sulfur content of the crudes varies from 1.45 to 2.10 per cent.

In the Cedral-Lignitico-Filisola reservoir, 16 wells are flowing and 54 are producing by artificial lift. The Lower Concepcion has 30 flowing wells and one on gas lift. El Encanto has 4 flowing wells.

Approximately, 5.5 million cubic feet of gas are utilized daily under El Plan's program of production by gas lift. The plant has nine high pressure compressors operating at 320 psi, and ten low pressure ones working at 125 psi.

A small gasoline absorption plant recovers a daily average of 160 barrels of gasoline. This gasoline is sent in tanks mounted on barges to Agua Dulce, thence to the Minatitlan Refinery.

The field power plant uses about 2.2 million cubic feet of gas daily to generate power for the general workshops, pumping stations and auxiliary installations.

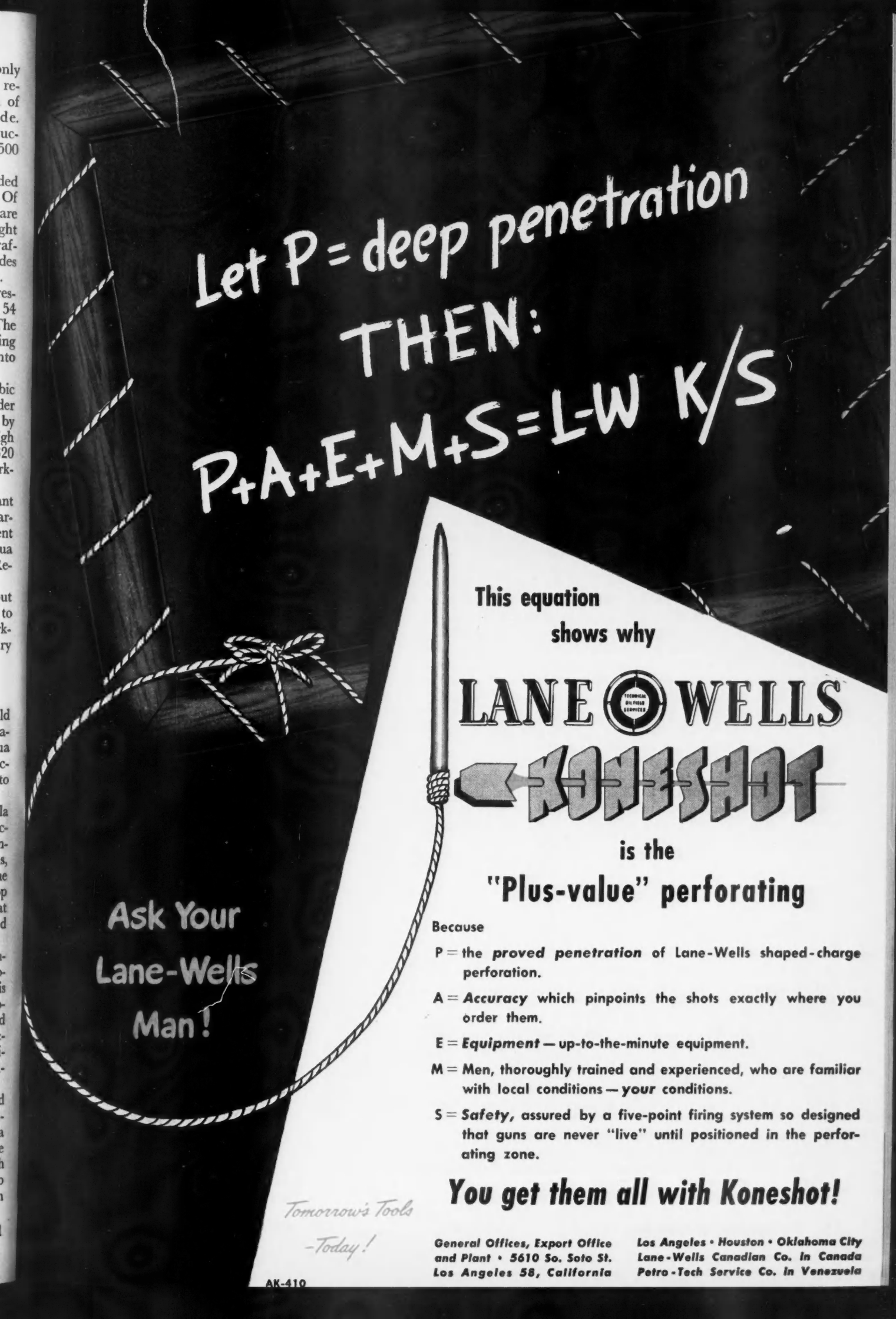
Tonala-El Burro Fields

The second most important oil field of the southern zone is the Tonala-El Burro unit, also known as Agua Dulce. The combined daily production of these two fields amounts to 3400 barrels.

Discovered in 1928, the Tonala structure is a salt dome, and production is obtained from the Lower Concepcion and El Encanto formations, both of Miocene age, and from the Deposito, in the Oligocene. The top of the first production is found at 1650 feet and the deepest hole drilled was 4290 feet.

The proved area at Tonala embraces about 470 acres, and the production thickness of the reservoir is estimated at 167 feet. Cumulative production at the end of 1950 amounted to 47,707,310 barrels. All 72 producing wells are pumpers, and much difficulty is experienced by sand accumulations and salt water production.

El Burro came in during 1930, and its discovery was based on the information obtained from the Tonala wells. The wells are completed in the Miocene, in the same formations which produce at Tonala. At El Burro the top of the Lower Concepcion



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is found at 2460 feet. The production thickness is 62 feet. The deepest well drilled reached the Oligocene at 5423 feet.

Daily production at El Burro is 1100 barrels, and the crude is of 26 gravity. There are 30 pumping wells, and the total area proved is 370 acres. Through 1950, El Burro has contributed 18,169,653 barrels of crude to the southern zone total cumulative production.

Other Southern Fields

El Plan and Tonala-El Burro account for 82 percent of the total oil production of the southern zone. The remaining production is from three smaller fields, Cuichapa-Acalapa, 1900 barrels; Filisola, 780 barrels, and Moloacan, 302 barrels.

Three important new discoveries may add to the present daily production of the southern zone. These fields are Jose Colomo, Fortuna Nacional and Rabon Grande. Pemex has formulated a drilling campaign for these areas.

The oil production of the southern zone is handled by pipe lines and barges, as follows:

El Plan—Oil is pumped to El Chapo terminal through a ten-inch, 22-mile long line, whose daily capacity is 20,000 barrels. The pumping pressure is 750 psi., and since El Plan produces two types of crude, paraffinic and non-paraffinic, the pumping schedules are worked out accordingly to handle these crudes separately.

Tonala-El Burro—This field is tied in to El Chapa terminal by an eight- and ten-inch line, whose length is 17.5 miles. About 18,000 to 20,000 barrels a day are pumped to El Chapo. The pumping schedule is arranged to care for paraffinic and non-paraffinic production.

Cuichapa-Acalapa—An eight-inch, five-mile line ties Cuichapa-Acalapa to El Plan-El Chapo pine line. The capacity of this branch line is 20,000 barrels daily.

Filisola—Oil is sent in barges to Minatitlan by the Uzpanapa and Coatzacoalcos rivers. The barges have a capacity of 10,000 barrels.

Moloacan—The field is connected to El Chapo-Nanchital pipe line by a branch line four inches in diameter and 7.5 miles long. The El Chapo-Nanchital line is ten inches in diameter and 4.7 miles long. Line capacity is about 30,000 barrels daily.

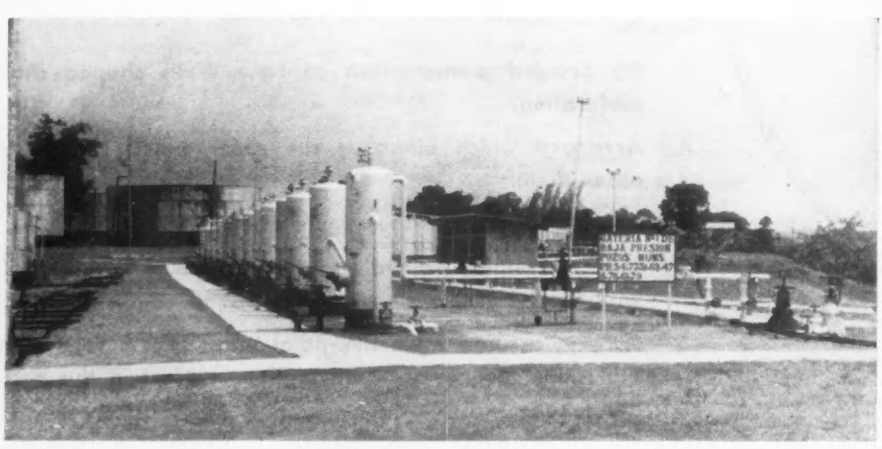
Tortuguero—Production from this field, whose daily production amounts to approximately 200 barrels, is pumped to Tonala. The line has a diameter of four inches and is 8.8 miles long.

El Chapo-Minatitlan — These two terminals are connected by an eighteen-mile, ten-inch line. Daily capacity is 24,000 barrels.

Currently, crude from new discoveries at Fortuna Nacional and Jose Colomo is shipped in 3000- and 5000-barrel barges to the refinery at Minatitlon. Storage capacity at Colomo consists of three 10,000-barrel tanks. One 10,000-barrel tank is situated at Fortuna. Storage capacity at the provisional terminal of El Bayo amounts to one 10,000-barrel tank.

Barges carrying crude to Minatitlan navigate the Chilapa and Grijalva rivers to the Gulf and from there go due west to the Coatzacoalcos river, and up river to Minatitlan.

Crude which has been destined for export can be shipped from the Nanchital or Minatitlan terminals. At Nanchital the storage capacity is 240,000 barrels, and at Minatitlan, 800,000 barrels. Average daily throughput of the refinery at Minatitlan is 20,500 barrels.



Low stage separation battery at Poza Rica.

Major Canadian Gas Field Indicated in Cessford Area

Canadian Delhi Oil Company reported Oct. 8 that development work in the Cessford area of southern Alberta indicates discovery of a major gas field. Cessford is about 100 miles east of Calgary.

Canadian Delhi has drilled ten wells in the area on farmout lands acquired from Hudson's Bay Oil and Gas Company, Ltd. Eight wells have been completed as gas producers, one was a dry hole and the tenth is being completed as another gasser.

Latest gas strike was at Canadian Delhi-Cessford 10, Subdivision 1, 27-25-12 W4th. Gas was found in the Lower Cretaceous on a drill-stem test at 3291-3333 feet. Rates of flow ranged from 4,360,000 to 5,417,000 cubic feet daily.

Cessford 9, completed about the middle of September, rated a potential of between 6 million and 8 million cubic feet daily. The Cessford gas-producing area covers about ten square miles in size.

Roumanian Oil Production Rising, Claim Communists

Roumania's oil production has almost reached the prewar production level in the Communists' effort to reach the 1955 goal of 74,530,000 barrels annually, satellite reports claim. In the first quarter of 1951, output was placed at 48,519,030 barrels in comparison with the 1950 yield of 40,693,380 barrels, 28,321,400 barrels in 1948, and 51,425,700 in 1938.

For the second quarter of this year, the Roumanian Statistical Office reported that production was 19.2 percent higher than for the second quarter of 1950. The annual production, therefore, is estimated at between 55 million and 57 million barrels.

Viata Sindicala, a Communist daily newspaper, reported that drillers at the Bacoi fields have succeeded in surpassing the drilling quota of the field and on July 19 began working on the September quota. A report at a Campina field oil meeting said the plan for the first half of 1951 has been overfulfilled by 11.99 percent, that drilling speed has been surpassed by 82.8 percent as compared with 1950, and that costs have been reduced by 8 percent.

Balkan specialists say it seems unlikely that a correctly operated oil field can turn out larger quantities at lower cost and in a shorter time.

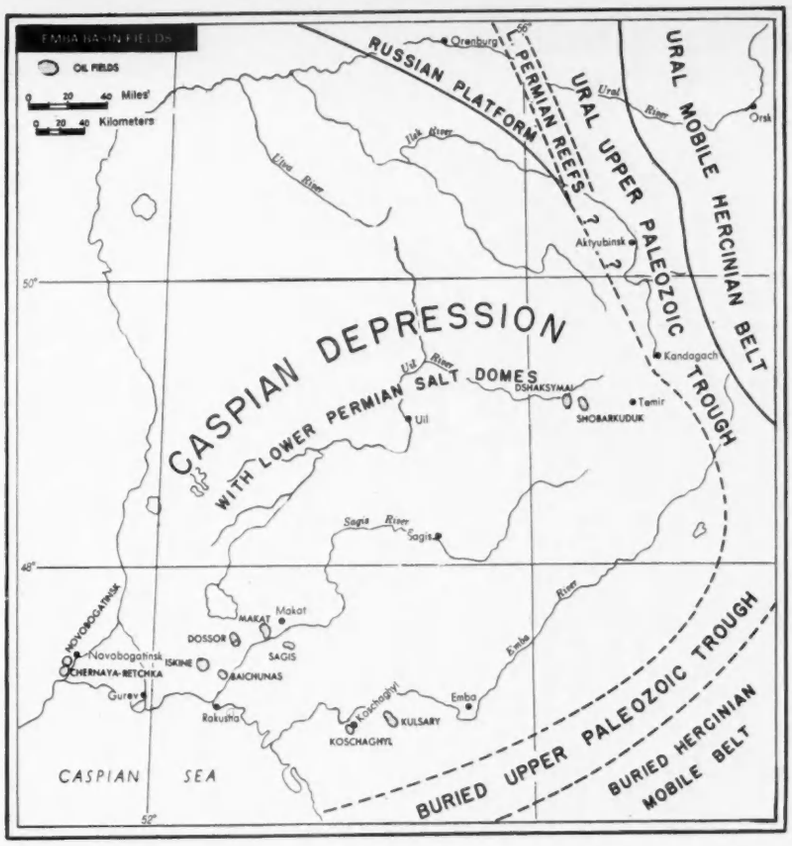


FIGURE 2.

A look behind the Iron Curtain

OIL IN RUSSIA

Part 2

By DR. LEONID SMIRNOV

THE economic and development status of the USSR oil industry was discussed in the preceding part, together with the general geology of the European sector of the country. More detailed discussions of the geology of individual oil bearing basins will be presented in this and succeeding chapters.

Caspian Depression Basins

The basin of the Caspian depression occupies the much lowered southeastern fringe of the Russian Platform. On the north and the west it is bounded by the Ural-Volga Arch and the Don-Medvieditza Arch, composed of Paleozoic deposits which yield commercial oil production. On the east the Caspian depression is bounded by the promontory Upper Paleozoic through of the southern Ural Mountains, and on the south by the buried hercynians of the Ural and of the Tian-Shan, tending to join up with the hercynians of the Big Caucasus. The Caspian basin is composed of Middle Paleozoic series, probably Devon and Carboniferous, then by Lower and Upper Permian deposits, Triassic, Jurassic, Cretaceous and Tertiary deposits. With this basin salt domes are connected. The salt of these domes is of the Kungur (Lower Permian) age but in the western portion, possibly Devonian salt also appears.

Oil is contained in the continental sands of Middle Jurassic and Neocom lying on the tops of the salt domes, and also in the Permian-Triassic deposits on the domes' flanks, in contact with the salt. In Eastern Emba the salt dome tops are covered with oil-bearing Permian-Triassic deposits. The question is up right now about drillings in the Artinskian (Lower Permian) series underlying the rock

FIGURE 3.

salt of the domes. This problem will doubtless be resolved at the place called Makat.

Thus far, about 1500 salt domes have been uncovered in the Caspian depression (Figure 2) but only 15 to 20 are under exploitation. There are on the domes also lithological beds connected with faults and breaks (gaps).

Ural-Volga Arch Basin

The great sloping Ural-Volga arch obviously is conditioned by the structure of the crystalline basement of the platform. It runs from the northeastern corner of the Voronezh crystalline massif towards the Urals. Beyond the Volga River it splits into a southern and a northern branch. On this slanting platform arch are accentuated individual elevations, very sloping and frequently flexure-like, with dome-like structures. On this arch Devonian Carboniferous and Permian rocks are developed. The Devonian lies directly on the crystalline basement. Shallow-water deposits of the Middle Devonian sea and the Pashian series widespread in the eastern part of the Russian Platform have proved exceptionally favorable for the formation and segregation of oil. The depth of the crystalline basement is about 1700 meters, although this depth within one occurrence (Tuimazy) ranges within about 6500 feet.

The oil bearing zone of the coal deposits is connected with the continental coal-bearing series of the Lower Carboniferous and the limestones of the Middle Carboniferous. As in the Caspian depression, in the Ural trough and at places on the Ural-Volga arch, the Lower Permian deposits are also oil-bearing (Buguruslan). Numerous structures have already been uncovered on this arch, but so far only about ten of them have gone into exploitation, which together with the Ishimbaevo region of the Ural trough already supply about 36 percent of the Soviet output. The Devonian are the most oil rich deposits. Detailed data on oil fields in this region are shown in Figure 3. According to an order of the Minister of Oil Industry, by 1946 33 structures were to be explored for drilling for Devonian oil.

The geological reserves of the Ural-Volga arch are very great, something on the order of a billion tons.

The Don-Medvieditza Arch

The Don-Medvieditza arch circles the Caspian depression on the northwest. It represents a new large oil-

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bearing area coalescing with the oil-bearing area of the Ural-Volga arch. The Don-Medvieditza arch represents a large platform structure of a flexure-like type, situated on the southeastern slope of the Voronezh crystalline massif, at the latter's sharp stepwise escarpment toward the Caspian depression. On the Don-Medvieditza arch a number of large structures of the dome-like type have been uncovered. Its deposits include Devonian and Carboniferous. Oil was found in both Devonian and Carboniferous in the same horizons as in the Ural-Volga arch.

The Ukrainian Depression

The oil-bearing basin of the Ukrainian depression was discovered only shortly before the last war. It is situated between the Ukrainian crystalline massif and the Voronezh crystalline massif, both of which are uplifts of the crystalline basement of the Platform. The basin of the Ukrainian depression is composed of Devonian, Carboniferous, Permian, Triassic, Jurassic, Cretaceous and Tertiary deposits.

In this basin are developed salt anticline structures with inherited trends of folding of the Donetz coal basin; the latter being a platform formation of the Wichita type, not a geosynclinal area. Commercial oil is encountered in a number of domes. The geological reserves of this basin apparently are considerable. Through a narrow arm located between the Donetz coal basin and the Voronezh crystalline massif, this basin is linked up with the basin of the Caspian depression of the Emba salt domes. The rock salt of the Ukrainian salt structure is of Devonian age. Oil has been revealed in contact with the salt and in the contact tectonic breccia.

The Pechora Basin

The pechora basin forms a sizeable depression between the Ural mobile belt and the Timan flexure-like structure formed by the crystalline basement of the Platform, elevated in the shape of block masses. Commercial oil is encountered in the flexure and structural terraces of Southern Timan, composed of Devonian deposits. Farther to the east in the Pechora basin are encountered anticlinal structures that pass into the structures of the Ural Upper-Paleozoic trough. The northern part of the Pechora basin passing into the Barents Sea is composed by Paleozoic and Mesozoic deposits. Here salt structures are probable, with the salt dating from the Carboniferous age.

Possible Oil-Bearing Basins of Russian Platform

One of the possible oil-bearing basins of the Russian Platform is that of the Southwestern slope of the Finnish crystalline massif. On this slope are developed Cambrian, Ordovician (Gothlandian in the Baltic) and Devonian deposits. Facies favorable for the formation and segregation of oil exist in the Lower Cambrian, in Ordovician, Gothlandian and Devonian. Also evaporites are developed. South of the Ilmen Lake, in the region of the city of Klin, there is a sharp elevation of the crystalline basement, near which a tapering-off occurs of shallow-water facies of Cambrian and Ordovician. Intensive exploration for oil are being carried on there. Deep drilling wells have been sunk near the cities of Staraya Russa and Tver (Kalinin).

Another such basin interesting from the oil-bearing viewpoint is that of the Moscow syncline, in particular, the Oka-Tsna arch situated on its southeastern rim. There are indications there of the presence of oil. Drillings on the Oka-Tsna arch are under way.

The Viatka arch, now being drilled at Vozhgaly, like the Ural-Volga arch, may prove oil-bearing. Its Devonian deposits are of the same type as those of the Ural-Volga arch. But no commercial oil has been uncovered as yet.

Cis-Ural Upper Paleozoic Trough

The cis-Ural trough, as was established before and after the war, has proved exceptionally rich in oil. This trough is composed chiefly of Permian deposits. From the oil viewpoint, of particular interest are the Artinskian deposits. In the east, near the inner end of the trough, the Artinskian deposits are expressed by a thick series of conglomerates which are thinned out with the departure from the said trough rim, and are replaced by carbonate deposits.

Near the outer rim of the trough, where the trough borders on the Platform, thick reefs appear. These reefs comprise the exceptionally rich Kama River oil fields. The oil-bearing zone of reefs is over 1000 meters thick. The reefs are traced along the outer rim of the trough over a distance of several hundred kilometers, close to Gorodki, in the region of the city of Perm (now Molotov). They are interrupted only at the Ufa plateau. The Artinskian reefs are covered by evaporites of the Kungur age, which in the same facies pass also into the eastern fringe of the Russian Platform. The Kungurian evaporites are covered by a thick series of red-colored Ufa rocks of the Upper Permian age. Besides the reefs, in the trough are uncovered normal folds on which oil was encountered in the rocks of Lower Permian, Carboniferous and Devonian as well as in Silurian. In the Silurian time, within the confines of the Upper Paleozoic trough, there prevailed platform conditions of precipitation. This indicates migration of the trough toward the west. (See Figure 4.)

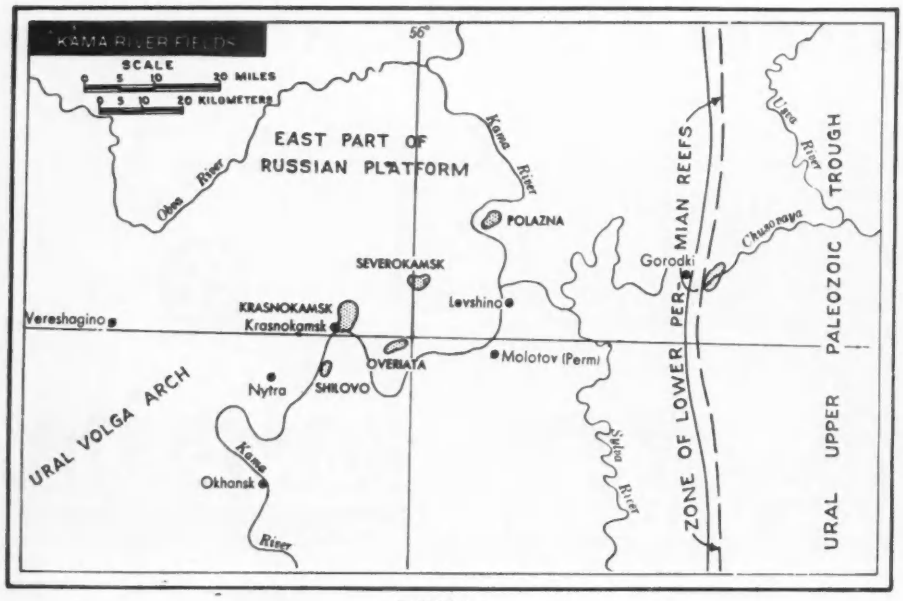


FIGURE 4.

(This is the second of a series)

Recognition for Oil Women

By ROSALIE JORDAN

Oil Industry Information Committee, Dallas

WITH THE enthusiastic support of their male colleagues, women in the oil industry have embarked upon an ambitious program, through the organization of Desk & Derrick clubs, to learn more about the business they work for. History and aims of the fledgling association are described in this article.

SOMETHING new on the oil horizon is being engineered by the women in the industry. From coast to coast, the distaff side of the many petroleum firms in the U.S. and Canada is enthusiastically and efficiently organizing under the banner of the Association of the Desk & Derrick Clubs of North America. Activities of local clubs, in towns such as New Orleans, Houston and Los Angeles, already are well known to oil men across the continent.

The whole idea for petroleum women to see something of a derrick as well as a desk was the inspiration of an alert secretary in the New Orleans office of Humble Oil & Refining Company. After nine years with Humble, Miss Inez Awty realized that she did not know any oil women other than those in her own company, whom she saw daily. She decided to do something about it. After all, she reasoned, the men in the industry all belong to organizations and know one another, so why not the women? The idea was immediately taken up by the girls in New Orleans and the first Desk & Derrick Club was a going concern in a matter of a few months. For her work as the founder of this movement, Miss Awty was named "The Outstanding Oil Woman of the Year" by the Spindletop Commission at its 50th Anniversary Celebration in Beaumont, Texas, January 10, 1951.

The Desk & Derrick Clubs have a worthwhile purpose. They firmly believe that the girls who work for the many segments of the industry can do better jobs if they know more about the industry. And a girl who knows more about her industry is naturally more valuable to her boss and her company.

The experience and work of the individual clubs prove that they can adopt a project and complete a program successfully. They hear top oil company executives talk on the various phases of their complex industry. They see movies, depicting everything from exploratory operations to the sale of the refined product at the service station. On field trips, the women go through refineries, inspect installations, even climb onto rig floors and observe drilling at first hand. For those lucky enough to live in the Gulf area, companies have sponsored trips to offshore drilling rigs and swamp-buggy excursions to remote wildcat operations.

Field trips form only a part of the program of the Desk & Derrick Clubs. While they are learning, they find they can be of service—and their offers of assistance are eagerly welcomed by their bosses. In New Orleans, the club sponsored two floats in the 1950 Oil Progress Week parade and furnished 80 girls to assist at the

Field trips are an interesting and exciting part of the program of the clubs. In this photo, a marsh buggy takes Desk & Derrick Club members to a remote drilling location.

Members of the New Orleans club are pictured on a float they sponsored in the 1950 Oil Progress Week parade.

When Well Conditions Demand A

NOT only does the Baker Model "D" Retainer Production Packer take care of the "every day," simple installations, but it is adaptable to many of those previously difficult or impossible applications.

This is due first to the construction of the Packer itself, employing two sets of opposing slips, with a Hycar packing element between them, so that the Packer virtually becomes a part of the casing, cannot be moved up or down the casing, and prevents fluid or gas from passing between the packing element and the casing. When the Setting Tool, used to set the Packer, is removed from the well, only the smooth-bore Packer is left in the well, securely packed-off, and ready for selection and use of the proper Baker Packer Accessory Equipment to meet production requirements.

ACCESSORY EQUIPMENT IMPORTANT

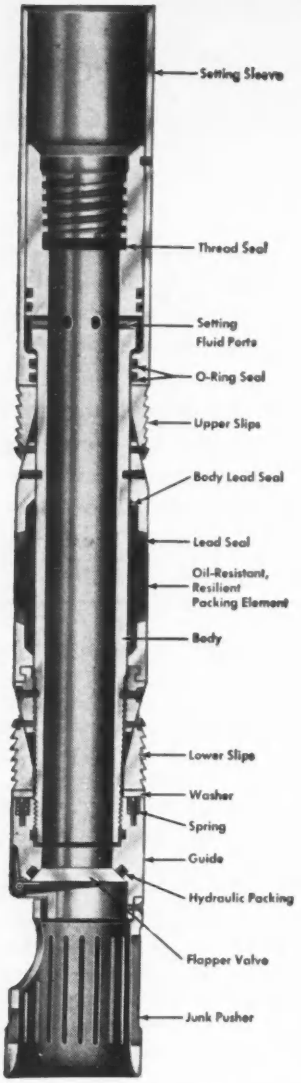
It is the complete line of Accessory Equipment that is responsible for the outstanding adaptability of Baker Packer installations to produce one or more zones, simultaneously or separately—through tubing or casing—and often with flexibility to permit production changes without pulling the tubing string.

One interesting and useful accessory unit is the Baker Tubing Seal Nipple, Multi-V Type (Product No. 448-D) which is an important element in many Packer installations to effect a fluid-tight seal in the annulus between the tubing string and the internal smooth bore of the Packer. This unit permits movement of the tubing string, either up or down, over the length of the Packer bore; and, for additional movement more than one Multi-V Tubing Seal Nipple may be used, as shown in Figure 1 on the opposite page.

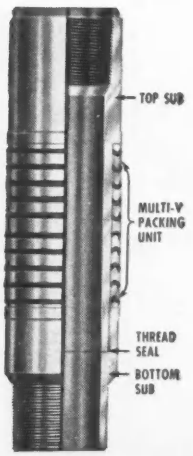
CONVENIENT LATCHING SUB

The Baker No Left Turn Latching Sub (Product No. 473) is positioned in the tubing string just above the Tubing Seal Nipple. This ingenious device does not effect a seal, but provides a quick-engaging, positive hold-down for the tubing production string, and holds the Tubing Seal Nipple in proper position in bore of Packer where it cannot be moved upward or downward by expansion or contraction of the tubing string.

Inasmuch as no "set-down" weight is required for operation of this Sub, the tubing can be suspended in tension, if desired, so that pressure bombs (and other devices) may be dropped readily through the tubing. Operations are not handicapped by "corkscrewed" tubing which often results when set-down weight is applied to conventional type packers.



Baker Model "D" Retainer Production Packer Product No. 415-D



BAKER TUBING SEAL NIPPLE, MULTI-V TYPE, which effects a fluid-tight seal between the tubing string and the bore of the Packer.

APPLICATIONS ARE MANY AND VARIED

In addition to the fact that the Baker Model "D" Retainer Production Packer is used for single-zone or multiple-zone production applications, it is ideal for isolating casing, for salt water disposal, for acidizing, re-pressuring, and many other applications.

Other features which appeal to veteran production men are its Complete Drillability—Resistance to High Temperatures—Corrosion-Resistant Construction—Freedom of the Tubing from the Packer—and Positive Anchoring Against Upward or Downward Movement.

In addition to conventional setting on tubing or drill pipe, WIRE LINE SETTING of Baker Production Packers is available thru leading service organizations. Ask any Baker office or representative for details.

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A PRODUCTION PACKER

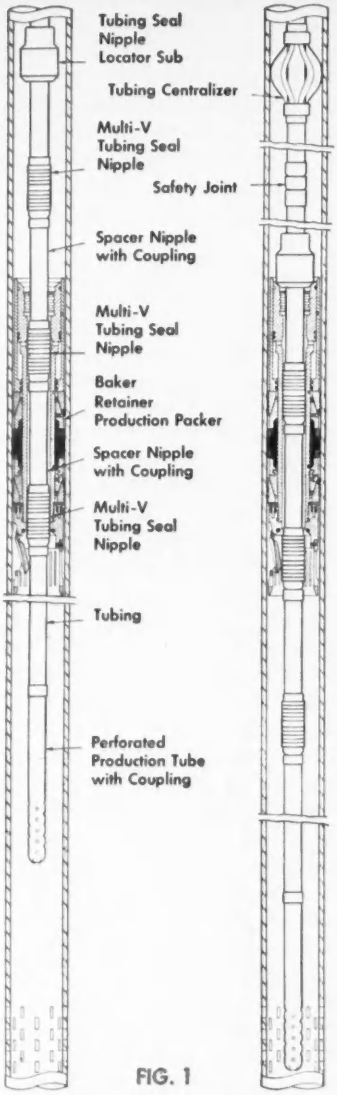


FIGURE 1—(left)

This single-zone installation is recommended where it is necessary to compensate for variations in the length of the tubing string, and to prevent excessive weight being imposed upon top of Packer when extreme increases in bottom hole temperatures cause expansion of tubing.

Three Baker Tubing Seal Nipples, Multi-V Type, are used, and spaced so that one Nipple is always sealed off in the bore of the Packer. The desired length of the tubing string is determined, to permit proper spacing of the Multi-V Nipples in the Packer and allow for proper connection at the tubing head. The tubing string is run into the well until the Baker Locator Sub contacts the top of the Retainer Production Packer. The tubing is then raised to remove the Seals from the Packer, to permit circulating and unloading the mud from the well. When the well has been unloaded, the tubing is set down and the final Christmas tree connections made.

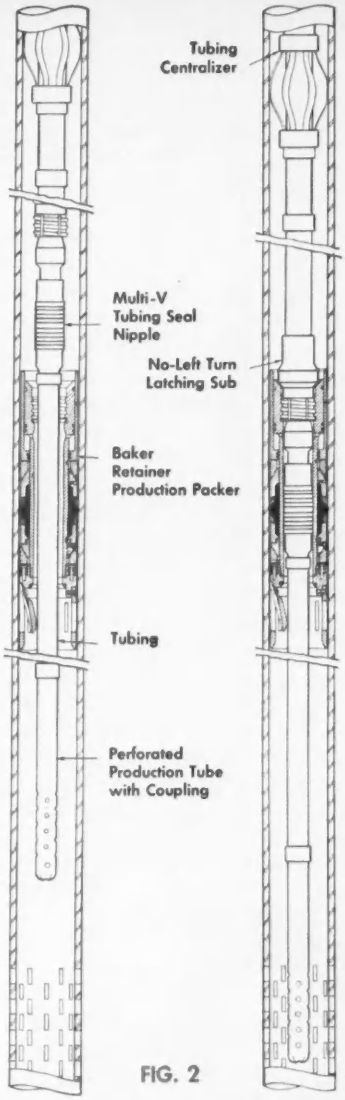


FIGURE 2—(center)

This hook-up is for producing a single zone with the production string anchored to the Packer, an advantageous feature when it is desired to: (a) produce the zone by pumping, while keeping the production string in tension; or (b) produce the zone by flowing without having to impose excessive weight on the Packer in order to hold the Tubing Seal Nipple properly positioned in the Packer bore; or (c) high pressure injection of gas or fluid for re-pressuring or secondary recovery.

The production string is run in the casing until the No Left Turn Latching Sub rests on top of the Packer. This is indicated at the surface by a drop in weight recorded on the strain indicator or the weight indicator. The production string is then raised approximately five feet, and in this position the zone may be washed and brought in, if it will flow.

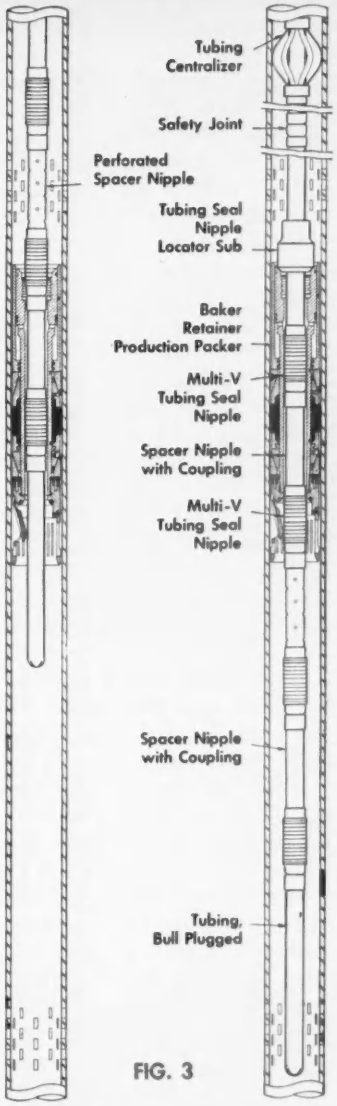


FIGURE 3—(right)

This two-zone hook-up permits washing the upper zone and unloading the annulus; or the upper zone may be killed through the tubing without running a side door choke on a wire line. The casing head used must pack off while the tubing is being raised or lowered. The Packer is set close below the upper zone, and the production string (made up as shown in Figure 3) is run in until the Locator Sub rests on top of the Packer, indicated by a drop in recorded weight on the strain indicator.

To wash the upper zone, or to unload the annulus, the string is raised about 8 feet to bring the Perforated Spacer Nipple above the Packer, but with the lower Tubing Seal Nipple inside the Packer bore. After the upper zone is brought on production through the casing annulus, the production string is lowered until the Locator Sub rests on top of the Packer. Weight of 10,000 pounds, or more if desired, may be set on the Packer, and the lower zone brought in through the tubing, by swabbing if necessary. To kill the well later, the lower zone is killed through the tubing; the production string raised (left view) and the upper zone killed. The production string is the removed from the casing.

Product No. 415-D

Retainer Production Packer

Oil Industry exhibits. They helped with the registration for the American Institute of Mining and Metallurgical Engineers convention in New Orleans. In Los Angeles, the Desk & Derrick Club helped with registrations and reservations at the annual meeting of the American Petroleum Institute there last fall.

With a sound program of this sort in operation, the Association for the U. S. and Canada began officially functioning on June 1, 1951. New Orleans was, of course, the first club organized, followed by the group in Jackson, Miss. Others, in order of their organization, are: Los Angeles, Houston, Shreveport, Calgary, Alberta, Denver, Ventura, Edmonton, and Dallas. Plans are under way for a club in Beaumont, Texas. The national organization currently includes more than 1500 women members working for about 350 petroleum firms throughout the country.

The first president of the Association of the Desk & Derrick Clubs of North America is Mrs. Lee Wilson Hoover of New Orleans, secretary to Alvin H. Howard, an independent oilman. A native of Mississippi, she started her career with a B.A. degree, majoring in voice and piano; she has been an active member of the Desk & Derrick Club since its beginning.

Serving as national first vice president is Miss Blanche Kelley of Los Angeles, secretary to Sam Grinsfelder, field operations vice president of Union Oil Company of California. The second vice president for the national association is to be elected by the Houston Club in June. Miss Enid Bahle, secretary to T. M. Johnson, Shell Oil Company land manager in New Orleans, is secretary of the association, and Miss Virginia Murray, dipmeter department supervisor with Schlumberger Well Survey Corporation, New Orleans, is treasurer. There is sound reasoning behind the fact that three of the top officials are in New Orleans. The decision to concentrate these officers in one chapter was made to honor the original Desk & Derrick Club and facilitate initial organizational work. Regional directors, one from each of the five regions long recognized by the petroleum industry, will be on the Association's board of directors.

The Desk & Derrick Club is active on the international scene as well. Mrs. Lucille Taylor of Houston, secretary to L. M. York, president of York Supply Company, attended the Third World Petroleum Congress in The Hague, May 28 through June 6, as a representative of the clubs. Mrs. Taylor cabled the news that oil women in Europe wanted to start a Desk & Derrick Club, too; however, the present heads of the Association felt that an international association should be tabled until all arrangements for the North American organization have been completed.

The present officers expressed their complete willingness to help local groups start clubs on the continent. Any women interested in forming new clubs may write to Mrs. Lee Hoover, c/o A. H. Howard, Hibernia Bank Building, New Orleans, and a packet of suggestions and ideas will be sent immediately.

The more than 1500 women who belong to Desk & Derrick represent not only secretaries of executives but also include a wide variety of other jobs as well. Among them are accountants, operators of business machines, receptionists, laboratory technicians, department supervisors, various specialists, and assistants to a number of technical and professional men.

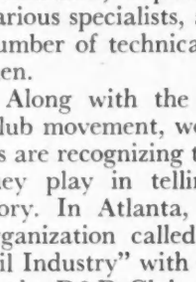
Along with the Desk & Derrick Club movement, women in other cities are recognizing the important part they play in telling the industry's story. In Atlanta, there is a going organization called "Women of the Oil Industry" with a program similar to the D&D Clubs; in addition, they embarked on a charity project to help support Battle Hill Haven, a home for incurables in Atlanta. A contribution is made each month to this home by the Atlanta Club, selection of this charity having been made after a committee had been appointed to investigate and submit the names of three worthwhile charities. Battle Hill Haven was picked by vote of the whole membership from the three submitted. In Boston, formal plans for New England's first club were formulated April 20; they will have special civic plans as well as oil education and social activities.

A recent highlight on women's activities was the Recognition Day luncheon sponsored by many firms in Dallas. Believed to be the first of its kind, this luncheon honored six prominent oil and gas career women in that city and an orchid was presented to each one. Orchids were also presented to two secretaries, outstanding for their ability as well as long tenure of service with their respective companies. Miss Inez Awty made a special trip to Dallas to be the featured speaker.

The development of the Desk & Derrick movement is a logical parallel to the increasingly important part women are playing in the industry's public relations picture. The Atlanta oil women's organization has the backing of the Southeastern Oil Industry Information Committee. As previously mentioned, the New Orleans Desk & Derrick Club had a major part in the 1950 Oil Progress Week celebration. Likewise, during Oil Progress Week, many local committees named Oil Progress Week Queens in their respective communities. In some localities, women are serving as chairmen of the local Oil Industry Information Committees, and an effort is being made throughout the country to include them in all phases of the industry's public relations activities.

It's easy to understand why Miss Awty, and the other members of the first Desk & Derrick Club, are a bit startled and breathless with their sudden leap to national fame. However, with a sound idea and a desire to learn more about their industry, they couldn't miss. Desk & Derrick Club members feel that a woman who is willing to devote spare time to education on the oil industry will get ahead—one who can succeed in any organization. Men think it's a good idea, too. Their stamp of approval is evidenced by their splendid cooperation in addressing the clubs and in arranging field trips.

Recognition Day for oil women has long been overdue and oil men are quick to give them the applause they deserve.



About the Author

ROSALIE JORDAN has been active in the oil industry's public relations program since 1947, and now is secretary to Don Agnew, representative for the Gulf-Southwest district of the Oil Industry Information Committee, Dallas.

A native Californian, Mrs. Jordan worked for the Automobile Club of Southern California in Los Angeles until 1942, when she resigned for overseas service with the American Red Cross. She was assigned to duty in the European Theater of Operations, and spent a year in England as a clubmobile captain for the ARC.

Her major interest is raising her seven-year-old son.

Of World Oil Men

DR. WALTER J. FENNY of Winnipeg, Manitoba, has joined Deep Rock Oil Corporation as the representative of its land and exploration division in Calgary, Alberta. His office will be located in Calgary.

A native of Canada, Fenny is well acquainted with the laws of the provinces of Alberta, Saskatchewan and Manitoba. He is a member of the Manitoba bar. Fenny is a graduate of the University of Manitoba law school, and received his doctor of law degree from the University of Chicago. His oil background includes leasing and title experience.

During World War II Fenny served with the Canadian army. He taught at Centennial High School, Winnipeg, before his army service, and was active in various educational associations.

•

NORMAN HARDY has been elected a vice president of Arabian American Oil Company and will make his office in the Dhahran, Saudi Arabia, field headquarters of the company. Prior to joining Aramco last February, Hardy was president of Richmond Petroleum Corporation, a subsidiary of Standard Oil Company of California. He first joined California Standard in 1926 as a geologist. He has worked in Indonesia, Holland and South America as well as in the U. S.

Norman Hardy

•

J. WHITNEY LEWIS, former consulting geologist of New York City, has been appointed mining law consultant to the Indonesian government at Djakarta, Indonesia.

•

DR. GUILLERMO ZULOAGA has been elected to the board of directors of Creole Petroleum Corporation. He joined the company in 1939 as assistant manager of the Geological department, became manager in 1945, and in 1948 was appointed to the management committee. He will continue in the latter post.

Dr. Zuloaga, born in Caracas in July, 1904, received a degree in philosophy and letters from the Central University of Caracas in 1924. He received the degree of doctor of geology from Massachusetts Institute of Technology in 1930. He returned to Venezuela the same year and joined the Ministry of Development as a petroleum inspector. Subsequently, he assisted in founding the geology and mining technical service section of the ministry with which he remained until joining Creole.

OILMEN ARRIVE in New York from Caracas, Venezuela, for a conference on material procurement for the oil industry in Venezuela. Left to right are Arthur Proudfit, president of Creole Petroleum Corporation; Joseph Fly and Robert Miller, also of Creole; and Richard McCrudy, Galfrid Dunsterville and William Starrgenburg of Asiatic Petroleum Corporation.

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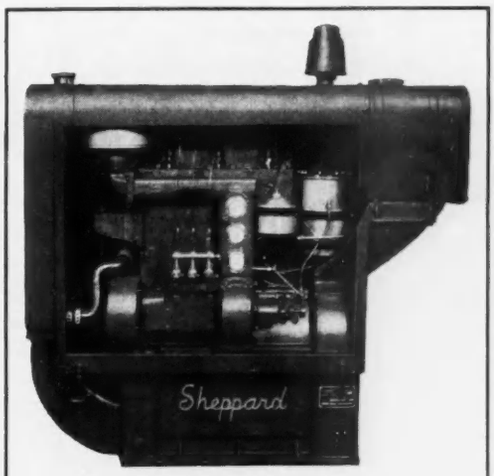

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Cretaceous Strike Steps Up Drilling Tempo in Canada

Drilling operations have commenced at one followup well about nine miles north of Edmonton, and at least five additional sites are slated for early development as the result of a Lower Cretaceous oil discovery by an Edmonton independent group.

A test drilled by Wagner Oils, Ltd., of Edmonton recovered 1440 feet of clean oil in a drill-stem test at 3674-85 feet. The well was Wagner-Matlo-Dillabough-Ad Astra 3. The belief was expressed that the strike had opened a new Cretaceous pool.

The Wagner well, subsequently placed on production, is directly north of Edmonton and about two miles northeast of the Campbell Cretaceous field. The Campbell sector, a small producing area embracing about 12 oil wells, is separated from the Wagner discovery by a string of dry holes.

Wagner, which holds a half-section lease from Ad Astra Minerals, Ltd., of Edmonton, made an immediate start on its first followup venture. Amigo Petroleums, Ltd., of Calgary, making its first venture into the exploration and development field, then put up $750,000 for a 50-50 share in the remaining wells on the Wagner lease. Matlo Oils, Ltd., of Calgary, holds an interest in a quarter-section of Wagner-Ad Astra land.

Barons Oils, Ltd., a Calgary firm, has announced intention to drill a quarter-mile offset to the discovery well. Other wells are scheduled on leased lands in the area north of Edmonton.

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Gulf's Canadian Wildcat Strikes Oil Near Stettler

Gulf Oil Corporation has a discovery at Gough 10, in Western Canada. Approximately eight miles south of producing fields at Stettler and seven miles north of Big Valley, the well indicates that the company may have a discovery of major proportions. Gulf has a strong lease position in the immediate vicinity of the well.

Production was obtained at 5175-5211 feet in the D-2 zone of Devonian formation. On drill-stem test for 30 minutes, gas came in after five minutes and oil after 25 minutes. Preliminary estimates of the well's production were set at 1700 barrels per day from 36 feet of pay thus far penetrated. The oil is of 31 gravity.

Drilling to determine if oil is present at lower depths is continuing. It is expected that the D-3 zone of Devonian will also be productive.

Through its subsidiary, Canadian Gulf Oil Company, Gulf has been a pioneer in the exploration for and production of oil in Western Canada. The company currently has 16 producers in the Stettler field and four in the Big Valley area. Gulf's holdings in Alberta are approximately 4,280,000 acres. In Saskatchewan it has 890,000 acres, and in Manitoba 362,000 acres. In addition, it is a one-quarter holder of 3,100,000 acres in British Columbia.

Danube Test Drilling

Soviet Mineral Oil Commission is drilling for oil south of the Danube in the area of the Enzersdorf and Schwadorf structures. Both of these structures, east of Vienna, were discovered and investigated before and during the war by Austrian and German companies.

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Russia's Satellites Offer Aid To Countries in Middle East

Drilling and refining industry equipment, machinery and technical assistance are being offered the Middle East and countries in the Levant by Czechoslovakia, Hungary and Poland. Proof of this lies in the technical missions which recently have left Europe through Trieste and Rjeka, on the Adriatic Sea, for Egypt, Saudi Arabia, Iraq and Iran.

The Czechoslovak Skoda Works has sent a mission headed by Jan Gross, chief of Skoda's industrial equipment and machinery department, to Iran to offer the Teheran government oil drilling and refining equipment to be paid for with crude. The mission left Rjeka on the Greek tanker Petros Nomikos for Bashra.

The oil in payment would be shipped from Iran to Roumanian Black sea ports, where it would be discharged in lighters of the Danubian Czechoslovak fleet.

The Hungarian nationalized engineering industry will open a branch office in Alexandria, Egypt, where rigs and other oil drilling equipment manufactured under German patents will be exhibited.

Eastern Germany engineering industries will invite Iraq delegates to visit factories in the Russian zone where rigs capable of reaching 1500 feet are being manufactured.

Meanwhile, Skoda is negotiating with the Bulgarian government for the construction of an oil refinery at Varna with a processing capacity of 3,385,000 barrels annually and a refinery at Burgas with a capacity of 5,416,000 barrels. Reforming units are proposed in both plants.

This announcement, coupled with the report that construction will be supervised by Russian military delegates, lends further credence to the new generally accepted belief that the Bulgarian oil industry is directly tied to the Russian military.

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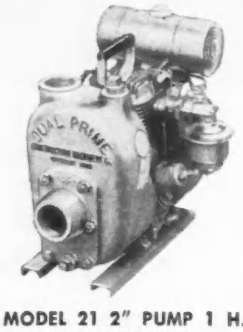

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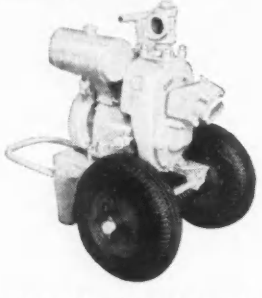

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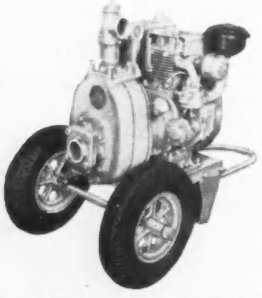

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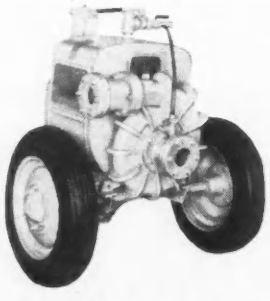

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West Germany Kills Report Of Expert Aid to Iranians

Reports from Abadan that 200 German oil experts will be employed as technicians in the Iranian oil industry have been refuted in Germany. No such proposal from Iran has been received by German authorities or oil companies. A survey of German field and refinery experts indicates none would favor leaving home for the precarious conditions expected in Iran.

While Iran may be able to enroll the services of some unemployed experts, a large scale migration is possible only through the federal government or oil firms. And the federal government declared it would regret any contracts signed by German experts with Iran.

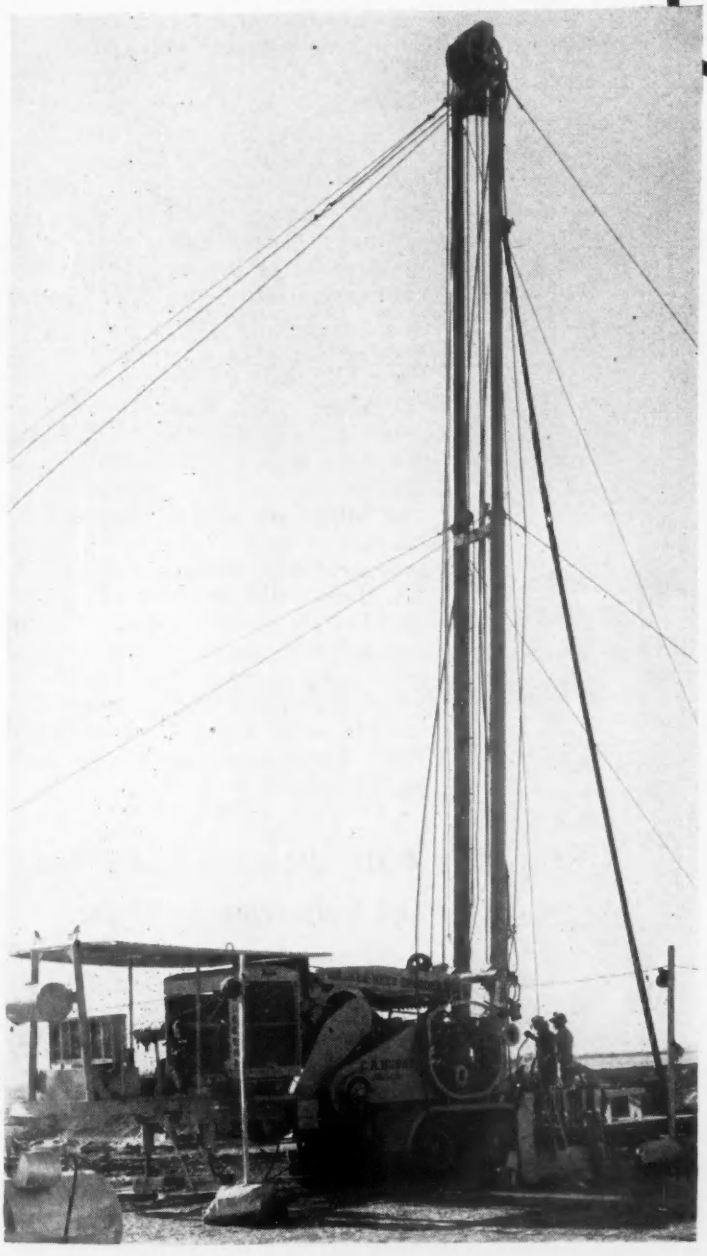
Deutsche Erdol-AG Begins 6500-Foot North Sea Test

Deutsche Erdol-AG has begun a deep well on the tiny island of Helmsand in the Meldorfer Bucht, North Sea. Scheduled to 6500 feet, the well is aimed at the reservoir beds of the rhaetic west of the Heide saltdonie structure. A previous well, Meldorf 92, showed several traces of oil after reaching the reservoir bed.

The derrick at Helmsand was erected atop a steel structure almost two miles off the mainland. Except for the shallower well, Cuxhaven 1001, drilled in 1950 in the tidelands off Cuxhaven, Helmsand is the first deep well outside the mainland.

C. A. Hurst's WALKER-NEER SPUDDER, Model C-37—operating near Midland, Texas—drilled the plug at 7200 feet, hit pay at 7600 feet, ran the tubing and completed the well in 12 DAYS—topping all previous records for similar jobs in the Spraberry Field!

"It's Caused Quite a Sensation Around Here!



"This," says Mr. Hurst, "is the smoothest running, fastest operating, most economical spudder I've seen—and the fastest to set up. We hoisted tools and bailer out of a 7600-foot hole in high gear (that's an average of 650 feet per minute for tools, 1250 feet per minute for bailer)—and the spooling, without any manual device, looked like it was done with a machine!

"We've set a new speed record for the Spraberry Field, and it's caused quite a sensation around here."

HYDROMATIC BRAKES

Mr. Hurst adds special acclaim for Walker-Neer's HYDROMATIC BRAKES (*double* 15-inch rotor), standard equipment on the C-37. They eliminate excessive brake band wear and brake ring heating, and constitute a tremendous safety factor.

He's Ordered Another One

Following this job, C. A. Hurst placed an order for another WALKER-NEER SPUDDER, Model C-37.

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Italians Fear Government Will Monopolize Refining

Ente Nazionale Idrocarburi, created as a government oil and gas monopoly in the Po Valley, will take over the government's participation in Azienda Nazionale Idrogenazione Combustibili — a development which has caused wide apprehension in private capital circles of the Italian oil industry.

With Standard Oil Company (N. J.) ANIC created the organization which operates the Leghorn and Bari oil refineries. Now, 50 percent of the capital of this organization, called STANIC, will fall under ENI control. Consequently, fears have been voiced by private Italian capital that a monopoly may also be created in oil refining, considering the nationalization tendencies so recently evidenced by the government.

The government decision to submit to parliament and senate the new mining law project on oil and gas research and exploitation has done nothing to relieve fears of the Italian oil industry. Blamed on this uncertainty is the current inactivity of several important privately-owned oil and gas companies and resulting unemployment.

One bright spot, however, is the recent signing of a contract between the Montecatini Company and AGIP in which the former is to supply methane for a new artificial fiber factory scheduled to be erected in the southern Po valley. The factory will compete with the Snia Viscosa, which has controlled the Italian rayon market.

The Italian government, meanwhile, has been asked again by Iran whether Azienda Generale Italiana Petroli would place its commercial organization and tanker tonnage at the disposal of the nationalized Iranian oil industry. One "catch" is that Anglo-Iranian Oil Company, deposed by Iran, owns equally with AGIP the Porto Marghera oil refinery at Venice.

However, Rome points to a way out —the Italian ministry for industry may turn over part of AGIP to the Raffineria Olii Minerali S. A. (ROMSA), one of the concerns to be taken over by ENI and which is not associated with Anglo-Iranian. ROMSA, then, could assist Iran by ordering from Italian shipyards new tanker tonnage as a part of the 150,000 gross ton tanker construction, plans for which are being drawn up at the Italian Ministry for the Mercantile Marine. The tankers should be completed by 1952.

AGIP Wants Nationalized Oil Industries To Unite

Azienda Generale Italiana Petroli, the Italian government oil agency, has suggested the creation of an International Association of the Nationalized Oil Industries in discussions with Teheran and Mexican governments. The new association, aimed at opposing the international organizations of privately-owned oil industries, would also include governments of Argentina and Venezuela, under the AGIP proposal.

Meanwhile, a Djakarta government delegate recently questioned AGIP on relations between the Italian state-controlled oil industry and the American and British oil companies. Several Italian petroleum industrialists have expressed belief in the rumor that Indonesia is only awaiting the outcome of the Iranian controversy before nationalizing her industry.

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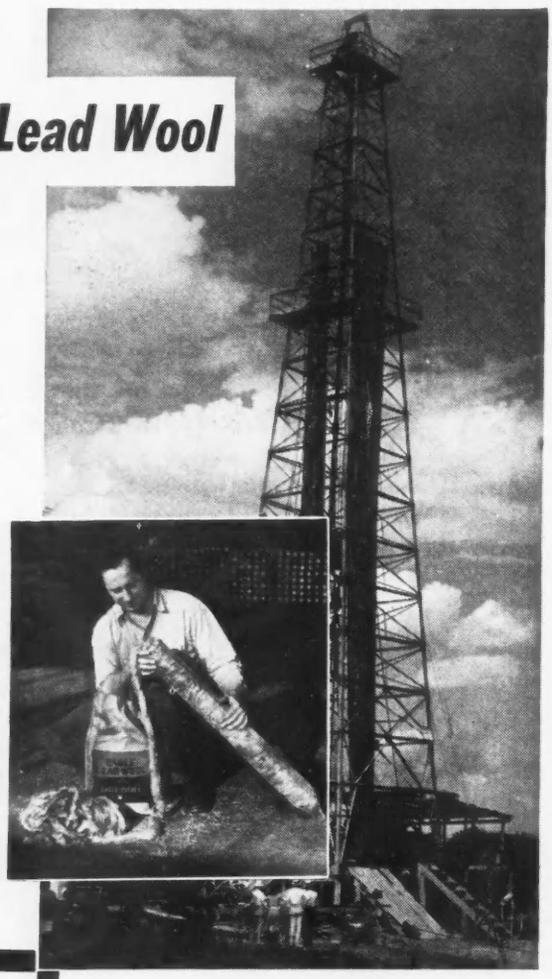

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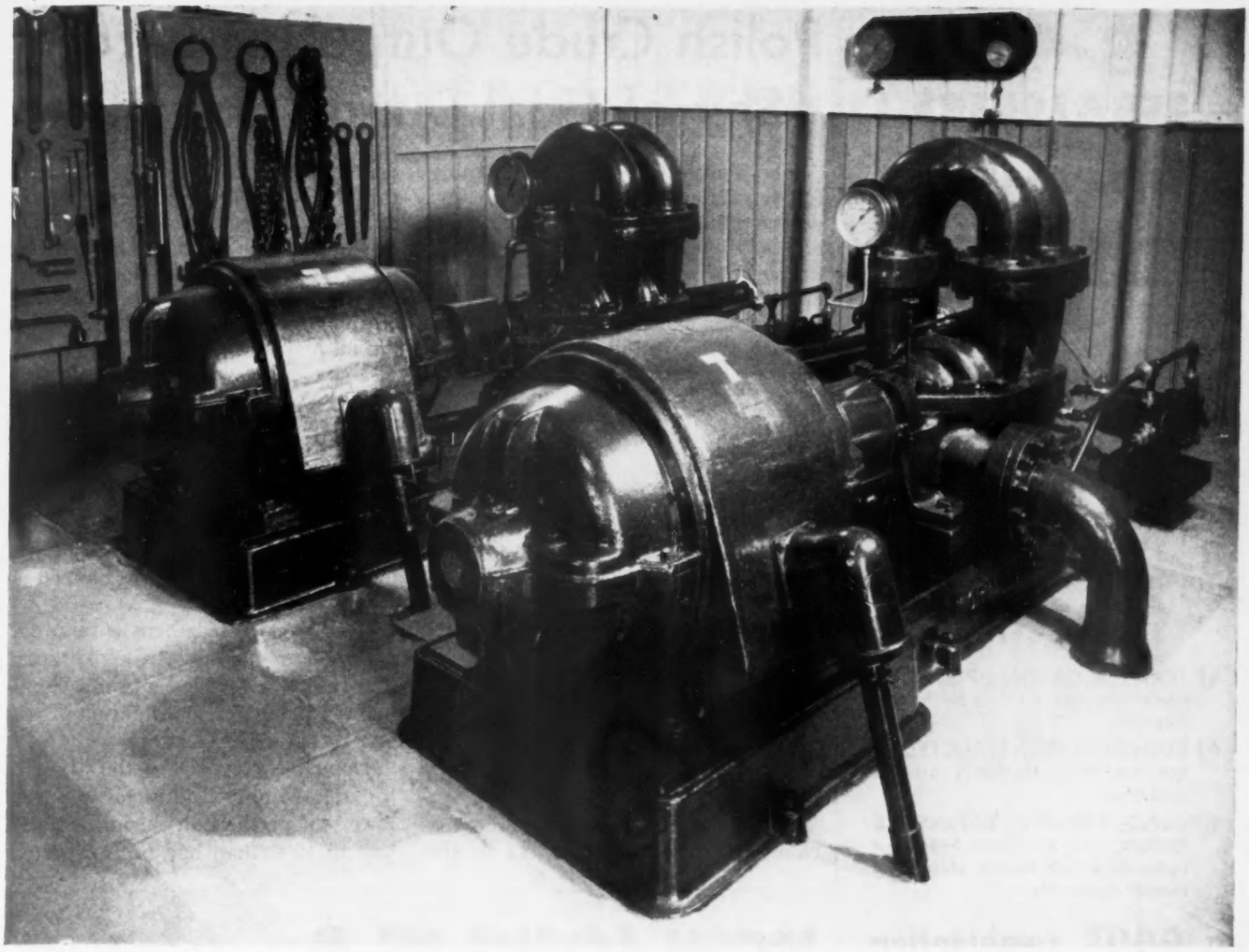

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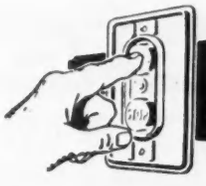
Shown above are two 250-horsepower, 3600 RPM centrifugal pipeline pumping units installed in a major oil company's pumping station in the Houston area in **September 1929!** Almost twenty-two years of continuous service!

From field to refinery, operators everywhere are discovering that electric equipment is a better investment for performance and dependability. Service records similar to the one established by the pipeline pumping units shown above are being recorded by electric equipment in all branches of the industry . . . day in and day out, year after year. This longer life and greater dependability, plus the low cost of electric power, are reasons why electric equipment is *first choice every time!*



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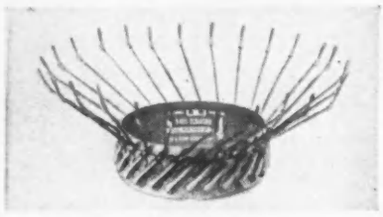

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Polish Crude Output 13 Percent Shy of Goal During First Half

The Polish Government Planning Office announced that oil processing during the first half of the year increased 9 percent over the plan set up for the whole of 1951. This increase is 49 percent greater than that for the first half of 1950.

Such an overfulfillment would raise the yearly output to approximately 1,224,135 barrels, about half of the planned goal of 2,670,840 barrels in 1955.

At the time of this report, the Ministry of Mining said oil production had reached only 87 percent of the plan during the first half of the year. A considerable percentage of the government allocation to the oil industry has to be spent at present for the maintenance of over-aged machinery and for the purchase of new field equipment. Czechoslovakia, and to a smaller degree Roumania and Soviet-Germany, is forced by the Cominform to ship oil field machinery into Poland.

Soviet Russia has forced the exchange of a Polish district in the Lublin area, which now is a part of the USSR, while a farther northern district was given to the Poles. In this negotiation, part of the Galician oil fields, which the Soviet took over in 1944, was returned to Poland. Although the value of the field has diminished greatly since 1944, the remaining crude will further help supply the nationalized transport system, operating under a strictly-rationed fuel and lubricant program.

The drop in Polish exploration, readily admitted by Director Drzewiecki of the Central Oil Industry Administration at a Communist party meeting held recently, was blamed on three factors.

Drzewiecki listed them as failure to use modern methods in exploitation, failure to fully utilize drilling equipment, and lack of coordination of various technological sections.

Deputy Nieszporek of the Ministry for the Mining Industries reported lower oil production during the first half of 1951 than had been expected.

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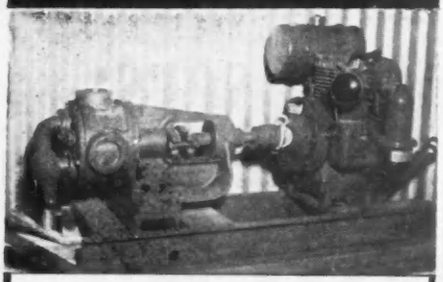

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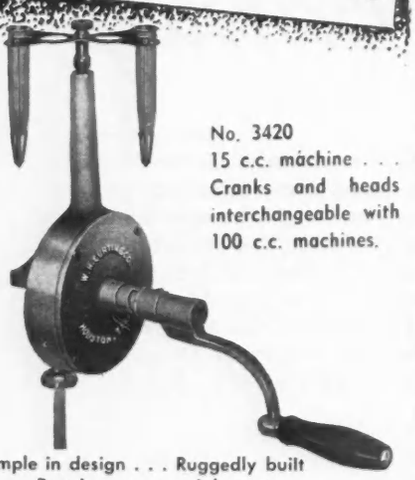

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Pakistan Oil Output Drops But Progress Made in Development

Considerable progress has been made recently in the development of the oil fields operated in Pakistan by Attock Oil Company, a British company. Crude produced in 1950 totaled 659,769 barrels, compared with 745,604 barrels in 1949. This relative drop was due mainly to reduced requirements from existing wells in the Joya Mair field. Production from the Dhulian field followed its usual declining trend.

Offsetting these factors to some extent was the higher Balkassar field output. A slight increase in production from the Khaur wells was reported.

Attock Oil is in close consultation with the Burmah Oil Company, Ltd., in connection with the development of the two adjacent fields at Balkassar. During 1950, evidence was obtained that the oil-bearing strata of the two areas were in direct communication and, therefore, it was in the best interest of everyone, the Burmah Oil Company, Ltd., subsidiary, the Attock Oil Company and the Pakistan government, that an agreement should be entered into by the companies, embodying broad principles for the development of the areas as one unit.

The proposed agreement is now before the government of Pakistan for approval.

The main producers in Balkassar field are continuing to flow satisfactorily against back pressure held at the surface. In many oil fields irregular conditions are encountered and Balkassar is no exception. There have been two disappointing results.

One well which failed to yield production in the normal oil horizon, gave good promise of oil at greater depth. But, despite all efforts, no sustained production could be obtained. Another, although yielding moderate production, could not be increased, though the time spent on it provided pertinent information regarding the intercommunication of the oil-bearing limestone of the Attock area and that of the Burmah Oil Company's subsidiary to the south.

A new well in the Attock area located in a northerly position has been drilled to the limestones and has given encouragement. Casing was set at 8223 feet and drilling to completion was successfully concluded.

As a result of the geological information obtained from operations at Balkassar and elsewhere, it was decided to deepen the most suitably located well at Dhulian to explore the deeper formations. Fortunately, the well is in good mechanical condition and the loss of production meantime is small.

Deepening from 7722 feet commenced in mid-April and at present the well has been drilled to 8262 feet. During the course of deepening, water was struck but this was successfully cemented off and deepening resumed. At 8083 weet water in quantity showed again and re-cementing was necessary. Oil was found at 8262 feet and a production test was under way.

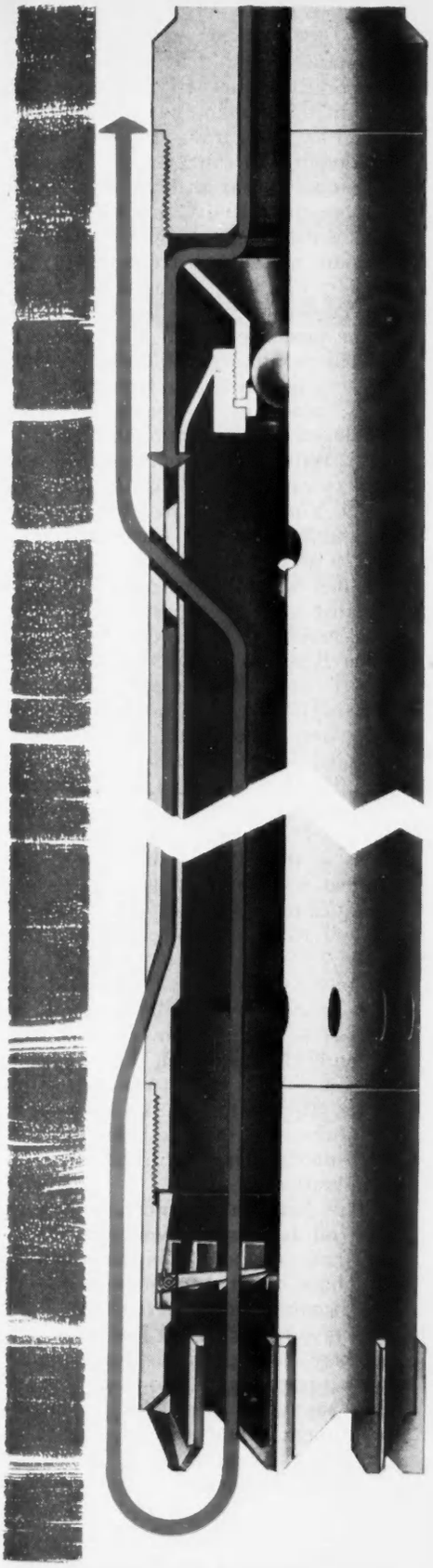
The test at Khaur was successfully carried down to the limestones, though this called for constant control of the course of the hole as drilling progressed. A string of casing was successfully run and cemented above the limestones and the well was drilled to 5400 feet. High pressure gas and oil were encountered, causing considerable caving. Efforts were being made to complete the well as a producer.

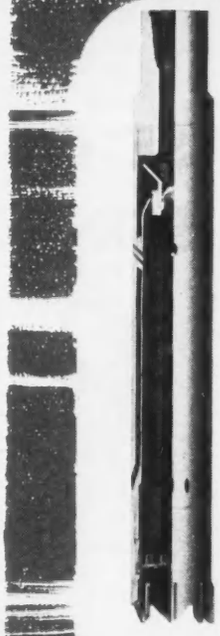
Last year, the necessity of forming one or more subsidiary companies incorporated and registered in Pakistan to conform with the new Pakistan petroleum rules was discussed. It now appears that one subsidiary company will suffice.

The new company, Pakistan Oilfields, Ltd., has been registered and the documents are now before the controller of capital issues, Pakistan government, for his approval and sanction to issue the prospectus. The principal feature of the prospectus, the preamble of which has already been agreed by the Pakistan government, is that 70 percent of the capital of Pakistan Oilfields, Ltd., will be taken up by Attock Oil Company and 30 percent reserved for subscription by nationals of Pakistan.

Meanwhile, the government of Pakistan issued prospecting licenses over several areas for which applications had been made in the name of the new company. When the company is empowered to do so, tests on two of these areas will be spudded in.

THIS BOWEN JUNK BASKET REVERSES Normal Circulation TO CATCH ALL BOTTOM HOLE JUNK!





TO ASSURE COMPLETE, single-run recovery of *all* bottom hole junk—bit cones, tong pins, hammers, mill cuttings, etc.,—the Bowen Junk Basket *reverses* normal circulation to literally *push* objects into the basket. Its unique action is to divert normal circulation through side passages in the barrel so that it flows out against the full bottom hole circumference. Here the mud stream is deflected in a reverse action up through the center of the catcher barrel, through return ports and on out into the up-flowing direction of normal circulation. The action of the mud flowing in a continuous stream to the center of the tool and up through the catcher barrel carries all objects into the catcher for removal on pull out of the string.

Full pump pressures can be utilized because there is no danger of mud stream pressure bearing against and causing loss of the fish. And in addition, *the full circulation principle eliminates necessity for pulling wet strings!*

The Bowen *Reverse Circulation* Junk Basket is an ideal tool for recovering all types of junk, for coring medium-hard formations and for straightening holes drilled slightly off center. It is available in sizes from 4⅝" to 17½" and is engineered to recover all types of bit cones used to drill hole sizes within its range.

REVERSE Circulation AT THE BOTTOM OF THE HOLE ONLY!

When the steel ball rests on the valve seat, fluid is directed entirely through the inner passage of the Barrel and out the vents in its lower end. At full pump capacity the fluid is jetted outwardly and downwardly against the bottom of the hole where it is deflected to push all objects toward the center. Fluid flows in a continuous stream to the center of the tool and up through it to the return ports in the upper end of the Barrel, thus giving a reverse circulation action within the tool itself!

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Red China's 'Joint Operation' For Russia's Benefit Only

(The following report, forwarded to WORLD OIL by private sources in the Far East, sheds some light on Communist-controlled oil fields and installations behind the Chinese Iron Curtain. Though this report cannot be immediately authenticated, WORLD OIL believes the sources sufficiently reliable to warrant publication.)

Red China's agreement in April, 1950, with Soviet Russia providing for the joint operation of China's oil resources is a "joint operation" in name only. Almost all the oil Red China can produce is going to Russia.

It is flowing to Russia through Kansu, a 1400-mile pipe line, running from Yumen in Northwest Kansu through the Gobi desert to Russia's Alma Ata on the Trans-Siberian railway, unconfirmed reports said.

That the agreement merely formalized a previous concession by Communist Leader Mao Tse-tung is evidenced by the fact that construction on the pipe line began in February, 1950, two months before the agreement was concluded.

Evidence that Russia has taken over much of Red China's oil operations is indicated by the group of 120 Russian engineers, technicians and workers who have assumed control of the Yumen oil fields—the China end of the pipe line. F. V. Vasili Naikov and his contingent of assistants and workers, largely drawn from the Baku fields, now are in charge of fields developed by the Nationalist government. With the help of American machinery and technicians, 26 oil wells in the Yumen fields had been drilled by the end of the war, producing 20,225 barrels monthly.

When the Russians moved in, Nationalist engineers and technicians were removed. Shortly thereafter, when Russians found they were not expert enough to operate the American machinery, the Nationalist operators were re-installed. Russians then moved in their machinery to expand drilling, but failed. The machinery was not up to the standard required.

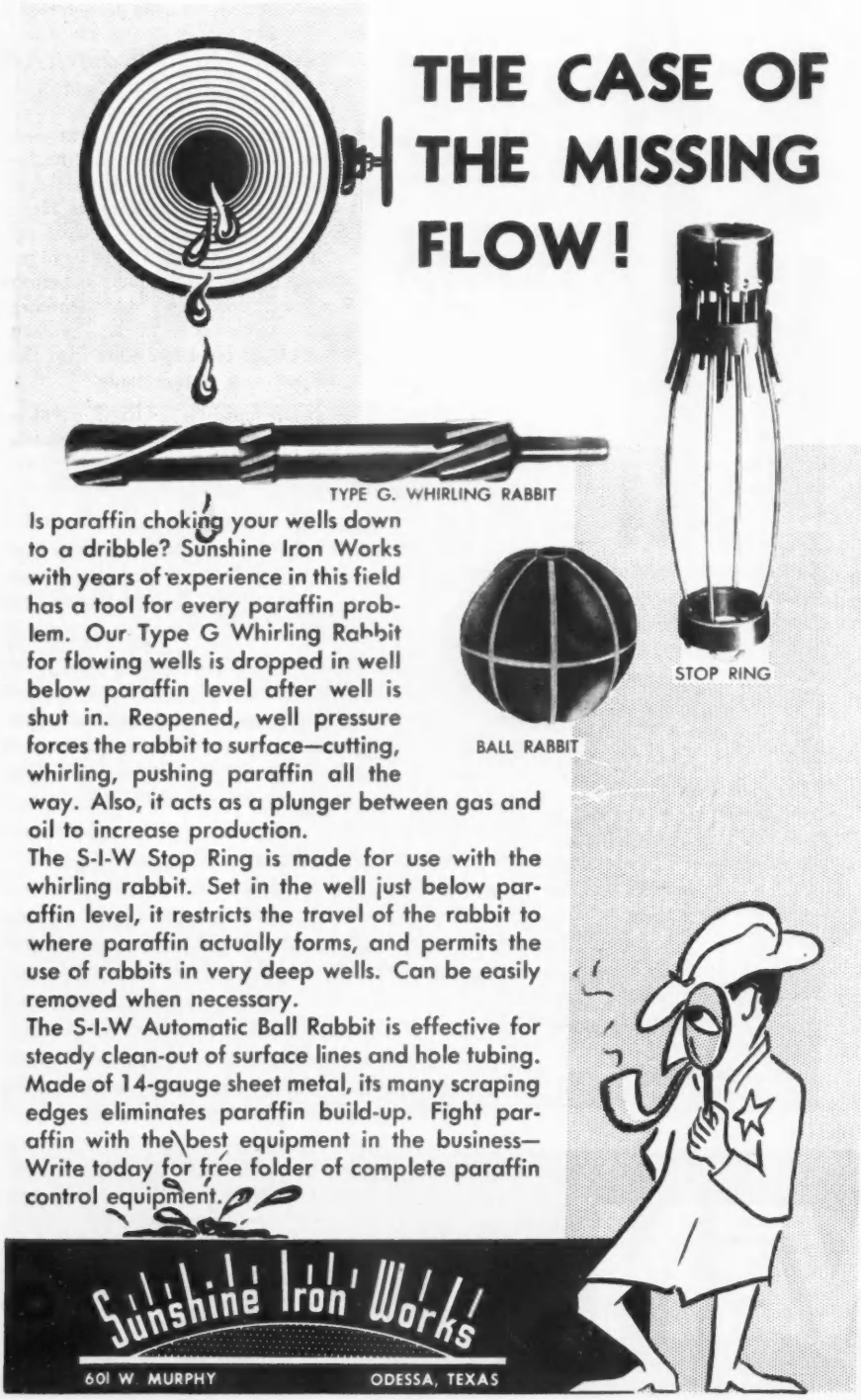
Current popular belief in the oil fields is that Russia deliberately refrained from expanding the refining facilities to provide an excuse to send the oil to Russia, ostensibly for refining.

Construction of the China-Russia pipe line was reportedly completed in February, 1951. It runs from Yumen through Hami, Chitai, Tihwa, Ining to Alma Ata. From Alma Ata, the oil is shipped to the Baku fields by rail, where it is now being refined. How much of it is returned to China is unknown.

This Russian exploitation of Chinese oil has caused widespread dissatisfaction among Chinese workers, who have resorted to sabotage on several occasions in an effort to stop the flow of oil to Russia. The frequency of these attempts indicates Communist propaganda of Sino-Soviet friendship has fallen short. Suspicions and resentment remain because the Chinese see their oil going to Russia for "refining" but don't see any of it ever return.

New Horizon Is Discovered

Suderbruch 3 in the Suderbruch field, owned jointly by Gewerkschaft Brigitta and Deutsche Vacuum Oel AG., discovered a third producing oil horizon in the Gigas formation of the Upper Jurassic. Further tests on White Jurassic formations in other wells will be held to determine the economic importance of the horizon.


THE CASE OF THE MISSING FLOW!
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STOP RING
BALL RABBIT
Is paraffin choking your wells down to a dribble? Sunshine Iron Works with years of experience in this field has a tool for every paraffin problem. Our Type G Whirling Rabbit for flowing wells is dropped in well below paraffin level after well is shut in. Reopened, well pressure forces the rabbit to surface—cutting, whirling, pushing paraffin all the way. Also, it acts as a plunger between gas and oil to increase production.
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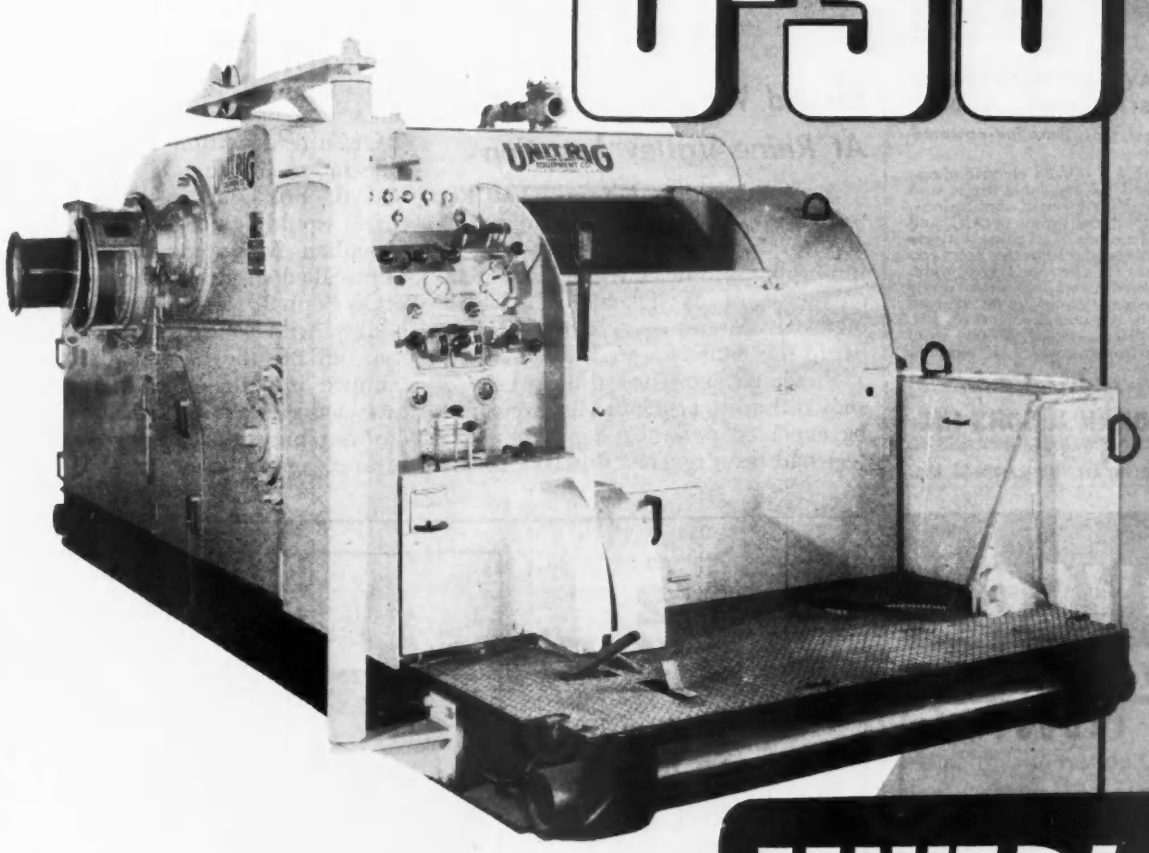

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Austria's New Field Called Major Petroleum Discovery

Austria's new Matzen oil field, south of the older Zistersdorf production area, has been classed as a major discovery by the Sowjetic oil administration. The Matzen discovery is the result of exploration by Rohoel Gewinnungs AG. (Socony-Vacuum Oil Company, Inc., and Shell Oil Company on a joint basis) before World War II. Viennese reports place Matzen daily production at 30,000 barrels daily. Austria claimed its 1951 production may reach 12,276,000 barrels, an increase of 2,046,000 barrels over its reported 1950 output.

Second Wildcat Under Way At Rhine Valley Location

A second wildcat, Gewerkschaft Elwerath's Wolfskehlen 2, is under way about 7 miles west of Darmstadt in the upper Rhine valley 1300 feet northeast of Wolfskehlen 1, which blew out August 3, caught fire, and lit up the Rhine valley for four days.

Previous experience in the area had shown that no crude or gas pay could be expected before a depth of 4875 feet had been reached, but Wolfskehlen 1 blew out at 2950 feet. On August 9, after the hole had collapsed to extinguish the flame and a mud fountain had shot up instead of gas, the crew regained control of the well. A flange and valve were put on the wellhead, which was still intact. The debris was removed and cement pumped into the well.

Edmonton District Well Capped After Wild Episode

Spewing crude 200 feet into the air at the rate of 2700 barrels daily, an oil well in the Edmonton district blew wild for 45 hours Sept. 9-11. The well is Standard Oil Company of California's Acheson 11-11, in the Acheson-Stony Plain sector seven miles west of Edmonton.

Grain fields within a three-quarter-mile radius of the wild well were oil-soaked. For hours, officials feared a spark would ignite the area. Royal Canadian Mounted Police officers were called to guard the area.

On Sept. 11, workers under M. M. Kinley, wild well expert from Houston, cut off the oil flow. Mud was pumped into the hole, and a seven-inch valve was installed above the blowout preventer to give double assurance against another outbreak.

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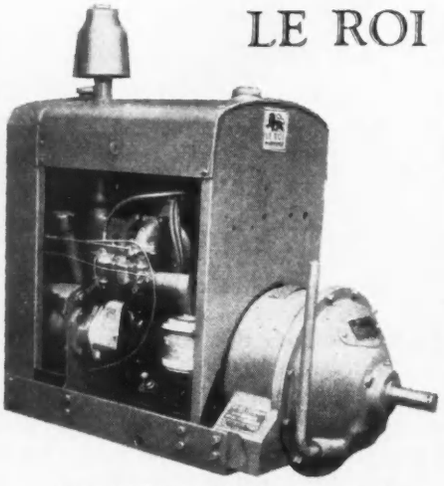

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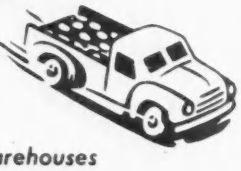

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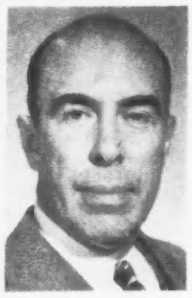
Men in the Industry NEWS

S. G. Loy



E. L. Krueger

S. G. Loy has been elected to the board of directors of Humble Pipe Line Company, replacing the late **L. E. Grissom.**

Other changes in the company's organization were the election of **E. L. Krueger** as secretary and assistant treasurer and **Horace F. Taylor** as assistant secretary. The latter office will be combined with the position of superintendent of oil movements.

Horace F. Taylor

Loy, comptroller of Humble Pipe Line Company since 1941, has been with the company since 1919. He was auditor from 1929 to 1941, when he was named assistant comptroller. He is a past president of the Houston chapter of the Comptrollers' Institute.

With the company since 1923, Krueger was made assistant to the treasurer in 1946. In 1949 he became assistant secretary and assistant treasurer.

Taylor spent ten years in the field after his employment in 1933 as pipeliner and telegraph operator. He was assistant chief clerk in crude oil dispatching from 1944 to 1945, when he was named chief clerk.

•

Clarence S. Beesemyer, executive vice president of General Petroleum Corporation, has been named national vice chairman of the American Red Cross' 1952 fund-raising campaign.

J. H. Miracle, former secretary of United Gas Corporation, has been elected a vice president, and **B. H. Winham,** assistant to the president, was elected secretary.

Miracle has been in the oil and gas business more than 30 years, and has been in the United Gas organization since 1931. He was elected secretary of United's subsidiaries in 1937 and become secretary of the corporation in 1946.

Winham, assistant secretary of two United subsidiaries, United Gas Pipe Line Company and Union Producing Company, joined the organization more than 20 years ago, and was named assistant to the president in 1947.

Wilbert O. Crain, former Houston attorney, has been appointed general counsel of United Gas Corporation, United Gas Pipe Line Company and Union Producing Company. **George D. Fiser,** formerly general counsel, has been named advisory attorney.

Saunders Gregg, also a former Houston attorney with Vinson, Elkins & Weems, has been made assistant to the general counsel in handling contract matters.

•

Rawleigh Warner Jr., Houston, assistant to the president, was elected assistant treasurer of Continental Oil Company.

Rawleigh Warner, Jr.

Warner, a graduate of Princeton University, joined Continental as assistant to the treasurer in 1948. In 1949 he was elected secretary, with headquarters in New York. He was named assistant to the president early this year.

•

L. C. Decius, vice president and director of exploration of the Western division of Tide Water Associated Oil Company, has retired. Decius had been with Tide Water and its former subsidiary, Associated Oil Company, more than 35 years, and at the time of his retirement was in charge of all land, geological and exploratory activities of the company in California, the Rocky Mountain area and Canada.

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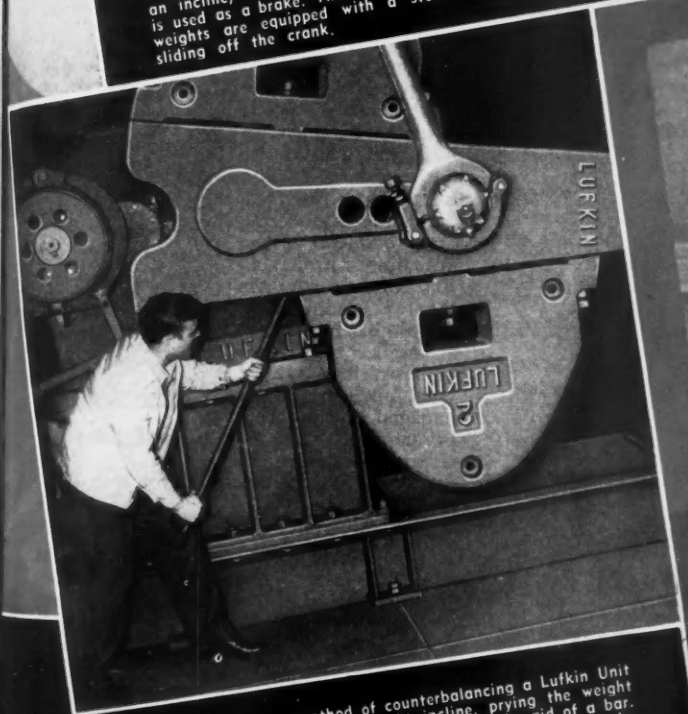
The Lufkin Trout Crank gives perfect counterbalance adjustment from minimum to maximum effect with the greatest of ease. One man can easily do the job. Two methods are illustrated herewith. Any method of moving the weights is safe because the weights are equipped with steel safety lugs to prevent sliding off the crank.

Operators find the Lufkin Trout Crank superior for oil field pumping units because of these outstanding features:

1. **EASE OF ADJUSTMENT**—one man can counterbalance a well.
2. **SAFETY**—a steel safety lug prevents the weights sliding off the crank.
3. **PRECISION** — counterbalance of minimum to maximum effect can be obtained by moving weights in a straight line.
4. **SIMPLICITY**—only three bolts to loosen.

"LET THE WEIGHTS DO THE WORK." Illustrated above is a very acceptable method of shifting weights on a Lufkin Pumping Unit. The crank is stopped on an incline, the three bolts are loosened and the lead bolt is used as a brake. This operation is quite safe because the weights are equipped with a steel safety lug to prevent sliding off the crank.



Another acceptable method of counterbalancing a Lufkin Unit is to stop the crank on a slight incline, prying the weight along the machined ways of the crank with the aid of a bar. This method is made easy by the notched bottom of the crank slot, enabling the operator to reach the desired position by an easy sliding motion.

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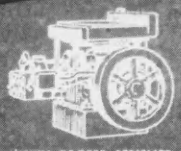
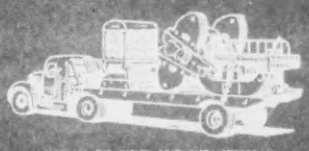


LUFKIN-COOPER-BESSEMER ENGINES •



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DIVISION LUFKIN FOUNDRY & MACHINE COMPANY INDUSTRIAL, MILL AND AUTOMOTIVE SUPPLIES •

L. F. Scherer has been advanced from chief engineer to assistant general manager in charge of construction and engineering for The Texas Pipe Line Company and Texas-New Mexico Pipe Line Company. He replaces **E. R. Osburn,** retired.

R. B. Trow was promoted from assistant chief engineer to chief engineer, Engineering division of the two companies. **R. W. Olbrich,** former special projects engineer, moved up to acting assistant chief engineer. **C. H. Albitz** was advanced from division manager, Oil Traffic division, to assistant general manager. **W. C. Montgomery,** former assistant division manager, is now division manager, Oil Traffic division.

Joseph W. Meehan has been appointed general manager of The Pure Oil Company's pipe line and crude oil purchasing. He has been with Pure almost 20 years, and has served in Mt. Pleasant, Mich., and Olney, Ill., as well as in Chicago, his present headquarters.

•

Gordon R. Stine, formerly of the firm of Cable & Stine, has opened an office at 225 Staley Building, Wichita Falls, Texas, for the general practice of petroleum engineering. He will engage in appraisals, operations, repressuring, water flooding, and reservoir studies.

Lee C. Lamar

Merrill W. Haas

Merrill W. Haas has been appointed chief geologist and **Lee C. Lamar** has been named assistant chief geologist for The Carter Oil Company, Tulsa.

Haas has been with Standard Oil Company (N.J.) and affiliates 17 years and recently has been staff geologist with Carter at Tulsa. He did college and graduate work at the University of Kansas, University of Michigan and Harvard University. He has been research paleontologist for Humble Oil & Refining Company, chief paleontologist for Standard Oil Company of Venezuela and division geologist for Creole Petroleum Corporation.

Lamar began work for Carter in 1932 following graduation from the University of Oklahoma. He was district geologist and landman in Michigan, transferred to Mattoon, Ill., as division geologist, and since 1947 has been on Carter's geological staff in Tulsa.

•

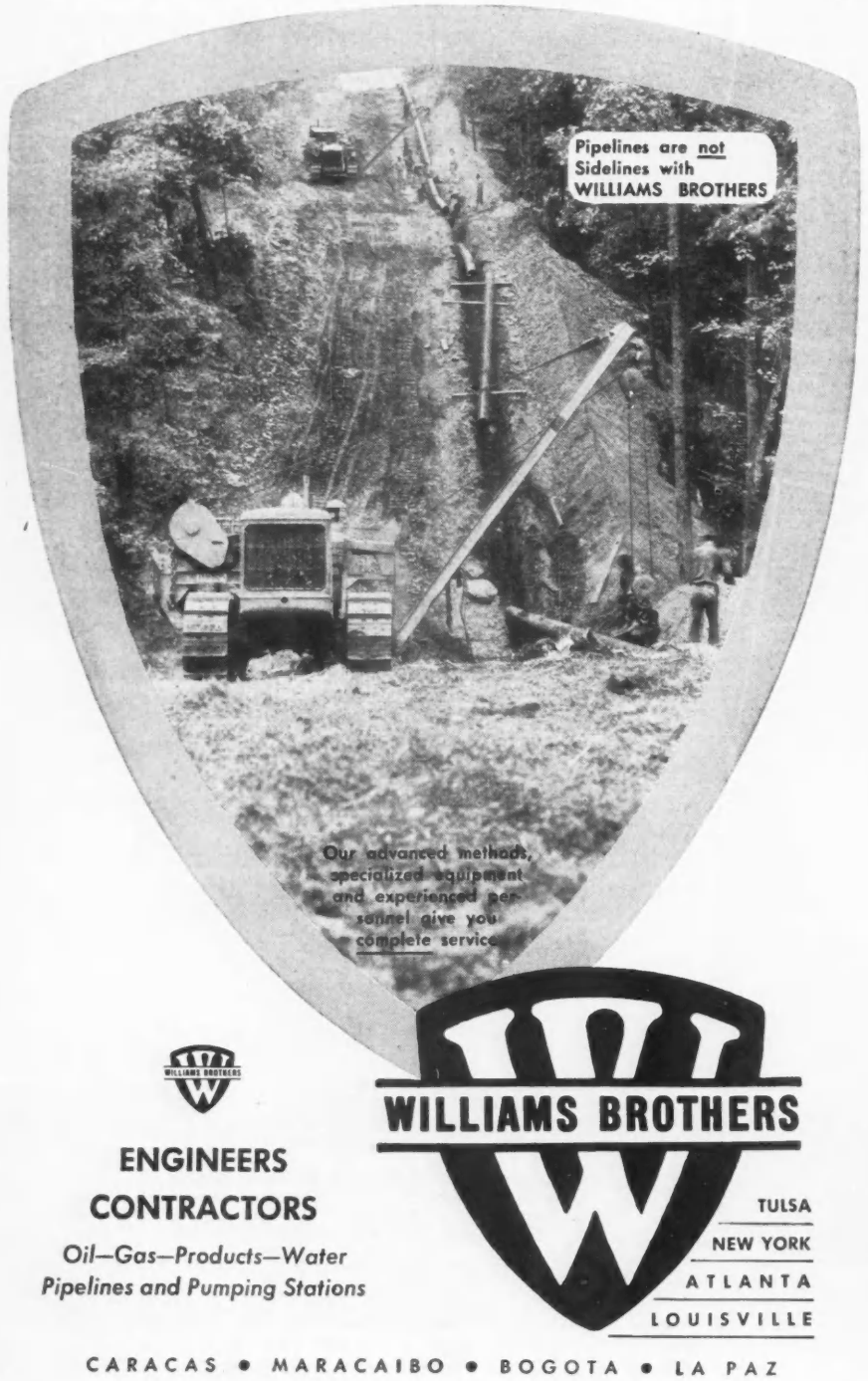
William E. Stiles has joined Buffalo Oil Company as vice president in charge of engineering. Stiles, formerly manager of sales and assistant to the president of Core Laboratories, Inc., will direct the engineering development of the company's producing properties from the Dallas headquarters. Buffalo has interests in a number of gas injection and water flood projects, and is engaged in a program to acquire additional secondary recovery properties and new reserves.

W. E. Stiles

•

Roger Gilbert has been named president of Panhandle Producing & Refining Company effective January 1, 1952, replacing **John V. Boyce,** who is retiring as president and a director at the end of this year. Gilbert, vice president of Atlas Corporation for the past 12 years and associated with that investment company since 1931, has been a director and chairman of the executive committee of Panhandle since 1947.

Roger Gilbert



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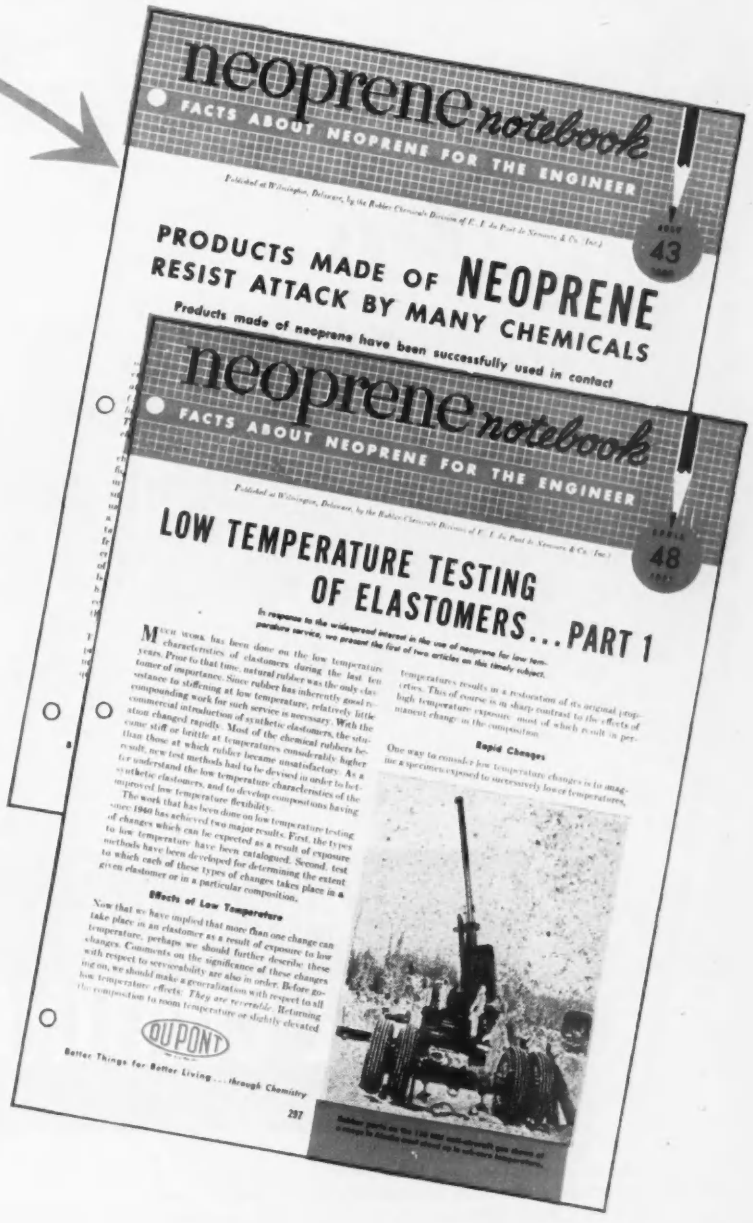
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Carl G. Holt

Carl G. Holt, formerly petroleum engineer for The California Company in the North Louisiana area, has joined Wheless Drilling Company, Shreveport, as drilling and production engineer.

A. F. Adcock has also joined Wheless, and is serving as toolpusher at Paradis, La.

Curtis H. Johnson has been promoted to assistant chief geophysicist in the Exploration department of General Petroleum Corporation. Formerly senior geophysicist for the company, Johnson will continue to make his headquarters in Los Angeles. Johnson was graduated from the University of California at Los Angeles in 1932 with a degree in physics. He joined General Petroleum in 1939.

Johnson was the first president of the Pacific Coast section of the Society of Exploration Geophysicists, and is a member of AAPG, American Geophysical Union, and the Offshore Seismic Operations Committee of Western Oil & Gas Association.

Dale M. Thomson

J. M. Clark

Dale M. Thomson and **J. M. Clark**, vice presidents, are in charge of the Midland, Texas, operating office of The Clark Dale Drilling Company, Inc., a new firm with main offices in Dallas. The Midland office will serve the Permian Basin and New Mexico.

Other officers of the company are **Charles E. Dimit**, president; **Creston Alexander**, vice president; and **A. M. Early**, secretary-treasurer, all of Dallas.

Clark, who will be in charge of the company's drilling equipment, has for the past 25 years been actively engaged in drilling and production operations with several drilling contractors and producers from the Rocky Mountain area to the Gulf Coast. Before moving to Midland, he was general superintendent of drilling for The Chicago Corporation in Corpus Christi.

Thomson has had 23 years' experience in the drilling and oil well servicing business, and he was associated with a drilling company in Oklahoma before moving to Midland two years ago. He was a district sales manager for The Western Company in Midland before resigning to enter the Clark Dale Drilling Company.

•

E. H. Blum has retired as vice president and director of The Atlantic Refining Company and general manager of the company's Production department. Blum, a native of Philadelphia, joined Atlantic in 1905 and moved to Dallas in 1919 to organize and direct the company's new producing headquarters. In 1936 he was elected a vice president and was appointed general manager of Atlantic's Domestic Production department, serving in that capacity until 1946 when he was put in charge of all producing activities, domestic and foreign. He was elected a director in 1937.

•

Robert W. Harrison, formerly with The R. B. Mitchell Company, has established an office at 504 City National Bank Building, Houston, as consulting petroleum engineer and geologist. His firm is operating as Robert W. Harrison & Company.

•

Edward C. Cram, formerly regional geologist at Dallas for Magnolia Petroleum Company, has been transferred to the New York office of Socony-Vacuum Oil Company, Inc., as assistant to the coordinator of domestic production.

Wayne C. Hammond has succeeded Cram at Dallas, and **C. I. Alexander**, who has been district geologist at San Antonio, has moved to Dallas as a regional exploration geologist.

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MEN IN THE INDUSTRY NEWS

W. M. Osborn has been named vice president and general manager of El Capitan Oil Company. Additions to the company's staff include **Lyle Brush,** who will manage the Exploration department; **R. C. Senning,** production geologist; and **Dave Morrison,** petroleum engineer in the Production department.

W. M. Osborn

Before joining El Capitan, Osborn was for eight years manager of the Geological and Chemical Engineering department of The Western Company, of Midland, Texas. In his new post, Osborn will be in charge of all operations, including exploration and production.

Brush was an independent lease broker in Midland before joining El Capitan, and Senning was on the geological staff of The Western Company. Morrison was formerly with George P. Livermore, Inc., in Lubbock, Texas. Both Senning and Morrison are University of Oklahoma graduates.

•

J. B. Jared, Jr., has been elected vice president and director of American Petroleum Company. He will be actively engaged in the management of the pipe line from the Houston office, in addition to his duties as chief civil engineer of American Republics Corporation.

Bennet B. Anderson, formerly district landman, Houston district, for American Republics Corporation, has been named to replace **F. S. Crockett** as assistant superintendent of the Land division. Crockett has been named manager of sales for the corporation.

James B. Darby has been promoted from landman and scout to district landman, replacing Anderson.

J. O. Trotter was named manager of the Traffic division of American Republics and American Petroleum.

N. M. Baird has been appointed assistant manager of American Republics' Production department, in charge of the Northern area with headquarters in Houston. **R. F. Sawyer** was named assistant manager of the Southern area, also with Houston headquarters. Sawyer was formerly operations superintendent, Eastern division, Beaumont, where he is replaced by **H. H. Morgan.**

W. T. Bryant was appointed assistant manager of the Production department in charge of gasoline and cycling plants.

Changes in the Petroleum division, Production department, include the following assignments: **Ralph I. Ellsworth,** from senior geologist to reservoir engineer, Houston; **G. D. Lightsey,** former senior petroleum engineer, Silsbee field, now senior petroleum engineer, Eastern division, Silsbee; **C. A. Shaid,** transferred from Joe's Lake to Silsbee as senior petroleum engineer; **W. L. Williams,** junior petroleum engineer, Houston, promoted to senior petroleum engineer; **J. W. Chervenka,** senior petroleum engineer, San Angelo, transferred to Houston as reservoir engineer; **John Chain,** junior petroleum engineer, Artesia, promoted to senior petroleum engineer, San Angelo.

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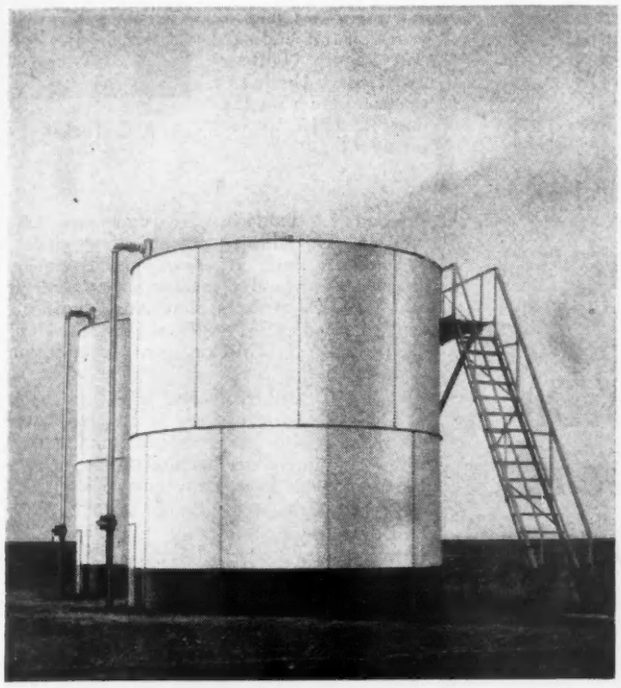

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MEN IN THE INDUSTRY NEWS

R. C. Tucker, vice president of George P. Livermore, Inc., and Great Western Producers, Inc., Lubbock, Texas, has been named president and general manager of both organizations. He succeeds **George P. Livermore,** resigned, who will continue as a director of the companies.

R. C. Tucker

Tucker has had 32 years of oil industry and supply company experience. He joined the companies on January 1, 1945, as vice president.

•

Elwood L. Baldwin, reservoir engineer; **William D. Elliott,** petroleum engineer; **Frank C. Folger, Jr.,** petroleum engineer; **Wayne C. Moody,** mechanical engineer; and **John D. Walters,** petroleum engineer, have joined the staff of Sunray Oil Corporation's Mid-Continent Production division, Tulsa.

Baldwin was formerly with Sun Oil Company, Mt. Pleasant, Mich. He holds an M.S. degree in petroleum engineering from the University of Oklahoma, and a B.S. in physics from University of Tulsa.

Elliott, formerly engineer with The Atlantic Refining Company, Gulf Oil Corporation and Core Analysis Laboratories, holds a B.S. in engineering and physics, and an M.S. in production engineering.

Folger, formerly with Stanolind Oil and Gas Company and Continental Oil Company, has B.S. and M.S. degrees in petroleum engineering from the University of Oklahoma.

A mechanical engineering graduate of the University of Arkansas, Moody was formerly division sales engineer with The National Supply Company.

Walters worked with various oil companies in Pennsylvania and Wyoming in engineering capacities. He is a petroleum engineering graduate of the University of Oklahoma.

•

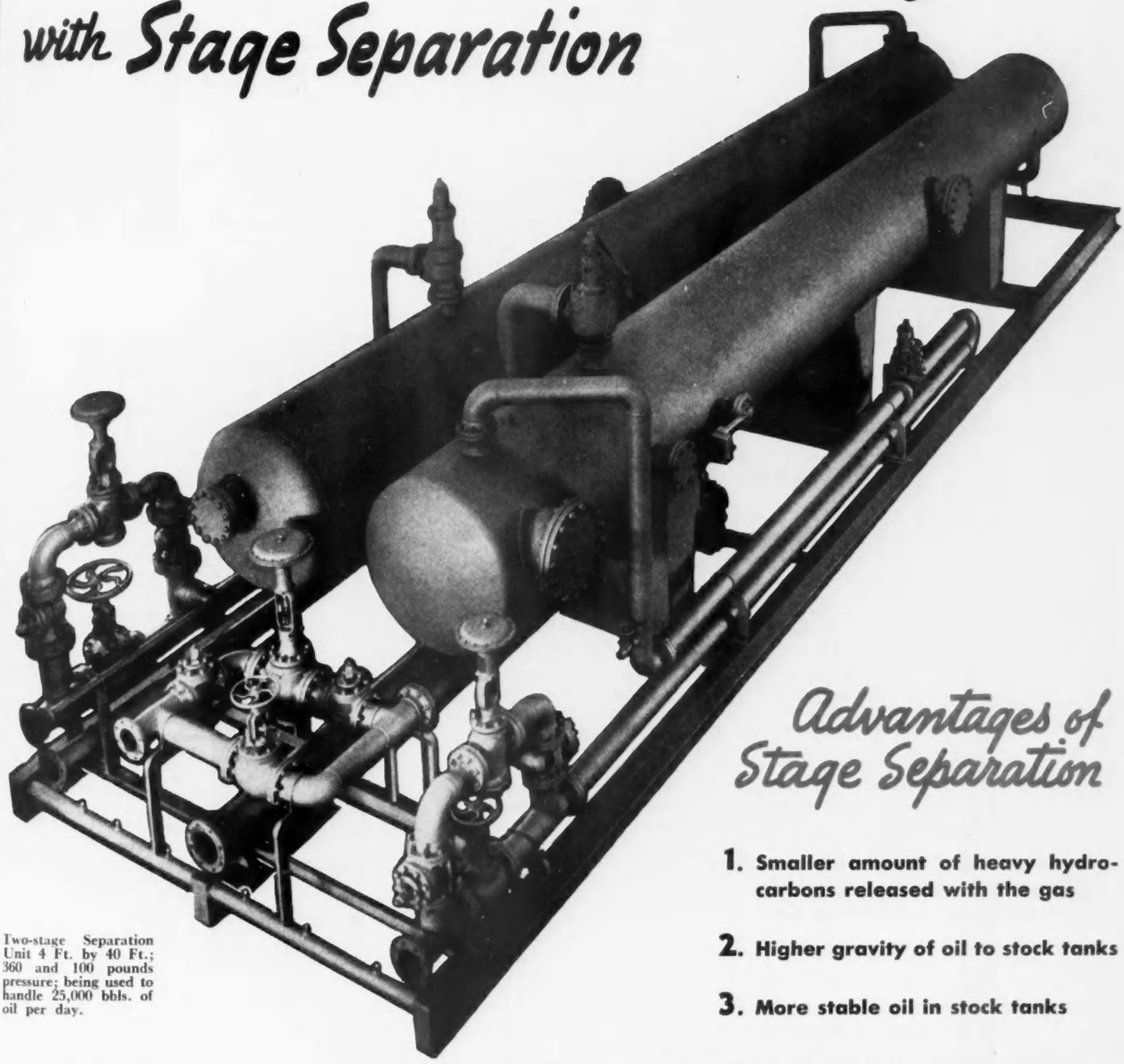
William Gruenerwald has opened offices as consulting geologist in the Pure Oil Building, 35 East Wacker Drive, Chicago. Gruenerwald has worked as petroleum and mining geologist in many parts of the world, including the Philippines, China, Tibet, Malaya, Central Africa, Canada, Brazil, Argentina and Venezuela. In the U. S. he worked for major oil companies in the Gulf Coast region, West Texas, and the Rocky Mountains. For the past two years he has been with Paul Weir Engineering Company, Chicago.

William Gruenerwald

•

E. D. Loughney has been named general manager of Canadian Gulf Oil Company, succeeding **John H. Bevel.**

More Efficient Recovery with Stage Separation



Two-stage Separation Unit 4 Ft. by 40 Ft.; 360 and 100 pounds pressure; being used to handle 25,000 bbls. of oil per day.

Advantages of Stage Separation

1. **Smaller amount of heavy hydrocarbons released with the gas**
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Maloney-Crawford packaged, skid-mounted stage separator units offer all the advantages of two stage separation plus the additional benefits of being completely shop assembled and skid mounted. They can be furnished with or without a by-pass arrangement whereby the individual separators may be by-passed, if desired. Tying in with field lines is only connection work required. Completely portable they may be used either for permanent or test installations. Variety of combinations in working pressures available.

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CANADIAN REPRESENTATIVE: Maloney-Crawford of Canada, Ltd., Edmonton, Canada
TEXAS PANHANDLE REPRESENTATIVE: H. W. Waddell, Pampa, Texas

J. R. Mills, Jr., formerly of Tulsa, has been appointed industrial relations supervisor for the Kansas division of Service Pipe Line Company, and will have headquarters in Wichita. Other new industrial relations supervisors are **J. G. Lowrance**, Nebraska division, headquarters at Topeka, Kansas; **Wilfred A. Colvin**, formerly of Bowie, West Texas Division, Lubbock, Texas; **C. J. Shulenberger**, formerly of Topeka, Missouri division, Carrolton, Mo.

Mills started with the company in 1931 as a welder at Seminole, Okla., and in the years since has held several types of jobs with the company. Following a period as supervisor of safety and industrial relations in Chicago, he returned to Tulsa general headquarters where he studied a refresher course in industrial relations before taking his new post.

Lowrance joined the Missouri division of the company in 1940 and worked in various posts in Missouri and Illinois. In August, 1950, he went to the general office in Tulsa as a job analyst.

Colvin joined the company in 1941 as a laborer, and in 1947 was promoted to division clerk and transferred to Bowie.

Since joining Service in 1937 as a laborer, Shulenberger has been promoted to various posts, and was most recently division warehouseman at Topeka.

J. B. Means, Jr., formerly district geologist for Skelly Oil Company in Corpus Christi, Texas, has joined Midstates Oil Corporation as district geologist at San Antonio. A graduate of the University of Texas with a B. S. degree in geology in 1940, and an M. A. in 1941, Means was with Tide Water Associated Oil Company from 1941 to 1947.

J. B. Means, Jr.

•

DEATHS

Dr. E. W. K. Andrau, 51, Houston geologist, was killed September 20 in an airplane crash near Lake Charles, La. Dr. Andrau was a Hollander, born in the Dutch East Indies. After several years in the Middle East as a geologist, he came to the U. S. in 1929. In 1931 he became a geologist for Shell Oil Company in Houston, leaving Shell four years later to establish a consulting geology practice.

•

J. C. Bruce, 63, district superintendent for the British-American Oil Producing Company at Oklahoma City, died September 25. Bruce went to Oklahoma from Pennsylvania in 1910 as a pipeliner for Gulf Oil Corporation at Hamilton Switch. He was later employed by several pipe line and oil producing companies, and was with Amerada Petroleum Corporation before he joined British-American in 1935. At the time of his death he was superintendent of the Central district, which includes Oklahoma, Kansas and Illinois.

J. C. Bruce

•

George M. Vandaveer, Jr., 49, vice president in charge of production and engineering for Midstates Oil Corporation, died September 17 in Tulsa. A 1925 graduate of the University of Wyoming, Vandaveer joined Midstates in 1940 as chief engineer. He was later made general superintendent, and in 1949 was elected vice president.

•

Douglas R. Brown, petroleum engineer and president of Research, Inc., Coffeyville, Kansas, died September 19.

•

Wells H. Rutherford, Sr., 51, died September 12 in Tulsa. He had been industrial relations executive with Stanolind Oil and Gas Company since 1945.

designed for deep wells-

HARBISON-FISCHER

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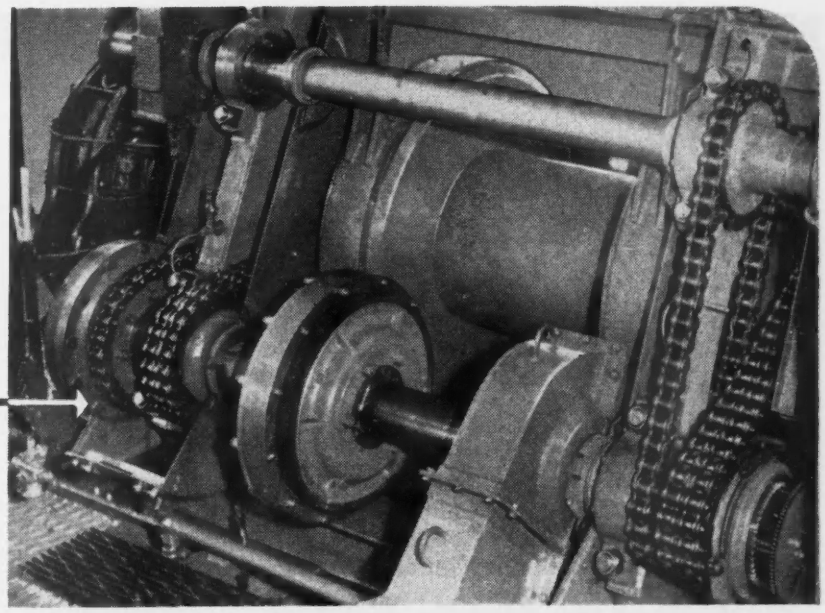
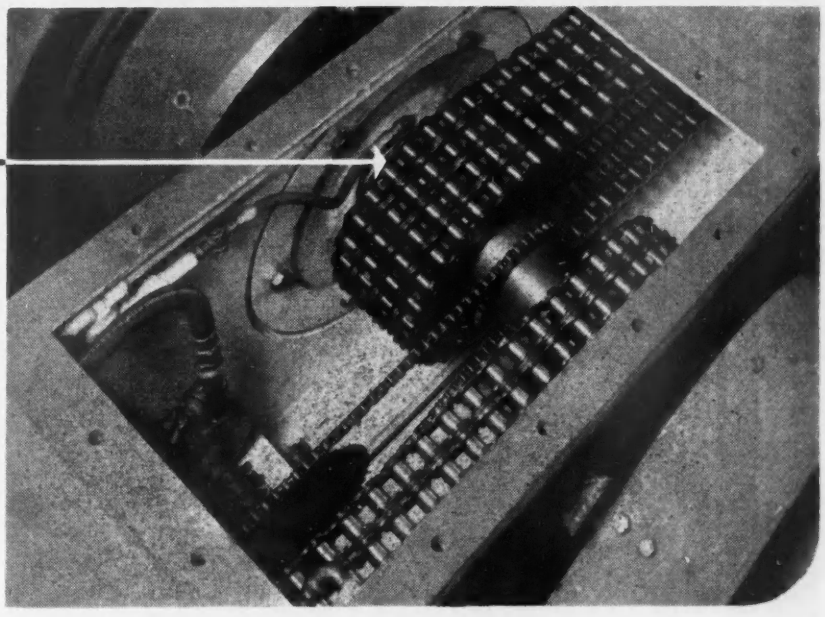
From Drawworks to Compounding Transmissions





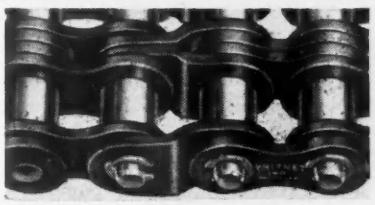
WHITNEY OIL FIELD ASSEMBLY CHAINS Keep Production Up, Cut Idle Equipment Time Down

Whitney Oil Field Assembly Chains on your oil well drilling equipment insure you of top operating speeds and dependable, long-lived performance that reduce costs, boost production . . . that's been the experience of leading machinery designers, manufacturers and users.

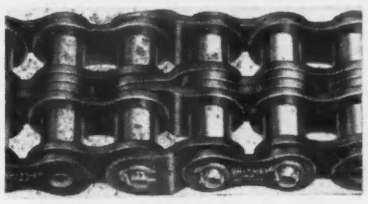
Quality constructed of heat-treated, alloy steel parts, Whitney Chain Drives deliver full machine output . . . supply high transmission efficiency, day in, day out, without breakage under the toughest field conditions. And remember, Whitney *snap-ring construction* and *offset links* simplify chain adjustments out in the field . . . keep equipment operating and reduce maintenance costs.

Look into Whitney Oil Field Assembly Chains for drawworks, compounding transmissions, selective transmissions, winches, rotary tables, spudders and other applications. They will save time and money, keep production up.

Compare These Maintenance Reducing Features



Whitney Lacing Arrangement makes field adjustment quick and easy...all you do is remove one or more offset links and your equipment is ready to keep on working.



Whitney Snap-Ring construction eliminates cotter pins . . . provides positive fastening. Snap-Rings are easy to remove, easy to install.

Whitney Chain Company

230 Hamilton Street, Hartford 2, Conn.

WHITNEY OIL COUNTRY WAREHOUSES

WHITNEY CHAIN COMPANY
5400 Pacific Blvd., Los Angeles, Calif.

WHITNEY CHAIN COMPANY
2914 Taylor Street, Dallas, Texas

KINZBACH Whipstocks and Mills-FIRST with oilmen for 24 years

Leading oil operators the world over use Kinzbach Whipstocks for side-tracking, straightening and directional drilling operations. They can be set at any depth, requiring no support for the bottom. Positive setting slips prevent slipping or turning in hole. They can be oriented to mill out in any direction. Patented hinge arrangement assures that top of Whipstock will lie close against pipe walls at all times, permitting easy passage of drilling tools. Setting trigger always locates whipstock between couplings so window will be within one joint. Available in all popular sizes of casing.

Type "A" Mill Type "D" Mill Type "H" Mill Type "I" Mill

Carefully heat-treated high-speed tool steel inserts from the cutting blades in Kinzbach Milling Tools. These inserts, set at most efficient cutting angles in properly shaped, high quality steel bodies provide unequalled cutting action and a uniform depth of cut.

KINZBACH TOOL CO., INC.
P. O. BOX 277 • HOUSTON, TEXAS

KINZBACH TOOL CO INC

Export Office:
74 Trinity Place,
New York, N. Y.

DEATHS

R. V. Hanrahan, 66, retired president of Humble Pipe Line Company, Houston, died October 11. Hanrahan started in the pipe line business in 1901, working in a field gang for Indiana Pipe Line Company. In 1904 he was made paymaster for a line being laid by the Ohio Oil Company between Illinois and New Jersey, but he soon went back to field work. He accepted a job with Standard Oil Company of Louisiana in 1909, laying a line between the Oklahoma border and Baton Rouge. When Humble was organized in 1919, he went to Houston as general superintendent to build the system that was to become Humble Pipe Line Company. In 1920 the was named a director of Humble Pipe Line, next year promoted to vice president and general manager, and then to president in 1925. He retired in October, 1950.

R. V. Hanrahan

•

John Evon Nelson, 73, formerly a director and an executive vice president of Gulf Oil Corporation, died October 6 in Pittsburgh. Nelson was also a member of Gulf's executive committee; a member and secretary of its finance committee; a member and chairman of its annuity and the service award committees; and a member of other policy planning committees. Under his direction also were the Gulf Building, Communications, and Insurance departments. On June 1, 1908, Nelson joined Gulf as secretary to **W. L. Mellon** and assistant treasurer. He was elected treasurer in 1922, and vice president and treasurer in 1939. In August, 1941, he became executive vice president, a position he held until his retirement on June 26, 1949.

•

John H. Alexander, 84, of Tulsa, one of the country's oldest independent producers, died October 3. A native of Pennsylvania, he brought in his first producer in Kean County, Penn. In later years he developed holdings in Oklahoma, Kansas and Illinois.

•

Louis Alan Bixler, superintendent for Midco Oil Corporation, Tulsa, died September 22 at Sapulpa, Okla.

•

Luther E. Grissom, 58, secretary for Humble Pipe Line Company, Houston, for the past 30 years, died September 15.

•

Leonadus H. Sharp, 75, formerly with the Production division of The Atlantic Refining Company, Tulsa, died September 12. He had been with the company for 23 years before his retirement ten years ago.

•

Frank G. Walling, 77, pioneer Oklahoma oil operator and retired attorney, died October 6. He went to Tulsa in 1913 and for many years was associated with Thomas Gilcrease in the oil business.

CLEAN FLOOR SAFE DERRICK

TYPE "R"

TYPE "S"

GUIBERSON
Wire Line Oil Savers

for Excellent Pack-Off—Clean, Dry Line

3 to choose from—take your choice and know that if it's Guiberson, it's *good!*

TYPE "R"—for tubing. Simple, inexpensive, effective. Split housing for easy installation.

TYPE "S"—for casing or tubing. Economical, simple—similar to "R" but heavier construction, flange bottom or tubing connection.

TYPE "D"—for tubing or casing. Two independent sets of rubbers, single end operation, make it cost more but still very economical. Pin or flange adapter connection.

Non-sparking brass bushings and guides throughout . . . long-wearing rubbers . . . finest Guiberson precision construction.

TYPE "B" RELEASING ATTACHMENT—Positive release for Oil Savers—prevents tool damage, necessity for flagging line. Easy to attach, pressure won't release it.

TYPE "D"

TYPE "B" RELEASING ATTACHMENT

Better Be Safe Than Sorry!

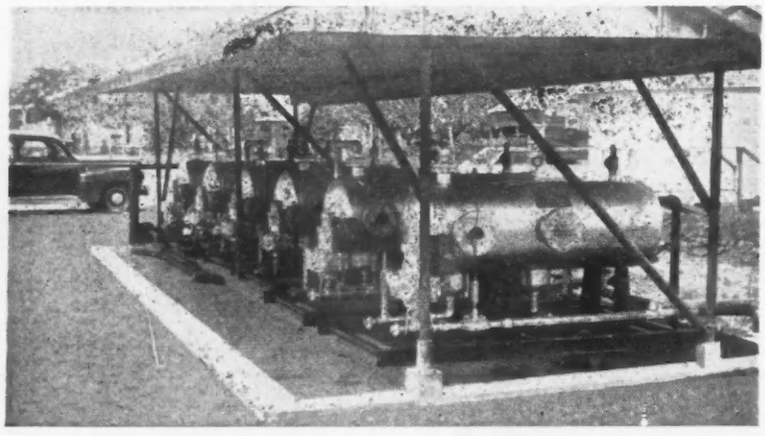
THE
GUIBERSON
CORPORATION
ESTABLISHED 1919 • DALLAS, TEXAS, U. S. A.
Sold By Leading Oil Field Supply Stores Everywhere

Associations

1952 AAODC officers pictured are, seated, left to right, Earle C. Flesher, Joseph V. Dunbar, A. W. Thompson, Brad Mills, Marion S. Church, and Louis A. Beecherl. Standing, left to right, are A. H. Bell, H. H. Hillman, E. K. Carey, J. U. Teague, N. H. Wheless, Jr., Harold M. McClure, Jr., R. S. Makin, and J. Doyle Settle.

ROLO WELLCHECKERS

PERMANENT AND PORTABLE OIL AND GAS SEPARATORS



This battery of six skid-mounted 4-1H-2406 Rolo Wellcheckers makes it possible to produce six one-well leases into a single tank battery. Installations of this type, of which Rolo Mfg. Co. has made many, are approved by regulatory bodies. Let us work with you on your problem.

Rolo Wellcheckers are made in all sizes to fit any operation. See Composite Catalog or write for illustrated Bulletin.

ROLO

Crude Oil Metering Specialists

MANUFACTURING COMPANY

2510 South Blvd., Houston 6, Texas

BRANCHES: Corpus Christi, Midland, Kilgore, Tulsa, New Orleans, Los Angeles. Casper, Calgary, (Alta.)

EXPORT OFFICE: R. S. Stokvis & Sons, Inc., 17 Battery Place, New York, N. Y.

AAODC Re-Elects Thompson President for Second Term

A. W. Thompson, Thompson-Carr, Inc., Houston, was re-elected president of the American Association of Oilwell Drilling Contractors at its annual meeting in Fort Worth.

Also re-elected were Joseph V. Dunbar, Dunbar Drilling Company, Salem, Ill., as vice president-at-large; Harold M. McClure, Jr., McClure Drilling Company, Alma, Mich., vice president for cable tools; Louis A. Beecherl, McDaniel & Beecherl, Dallas, treasurer; Brad Mills, executive vice president, Dallas; J. Doyle Settle, secretary, Dallas, and Marion S. Church, general counsel, Dallas.

New officers include Earle C. Flesher, Johnson & Flesher Drilling Company, Oklahoma City, vice president for Central Mid-Continent; A. H. Bell, Bell & Burden, Inc., Los Angeles, vice president for California, vice president for well servicing; J. U. Teague, Columbia Drilling Company, Houston, vice president for Gulf Coast; N. H. Wheless, Jr., Wheless Drilling Company, Shreveport, vice president for Cretaceous & Tertiary Basin; R. S. Makin, Makin Drilling Company, Hobbs, N. M., vice president for West Texas and New Mexico; Thomas S. Doran, Vandalia, Ill., vice president for Illinois, Michigan, Indiana and Kentucky.

Oklahoma City was selected as host city for the 12th annual meeting which will be held September 29-30, 1952.

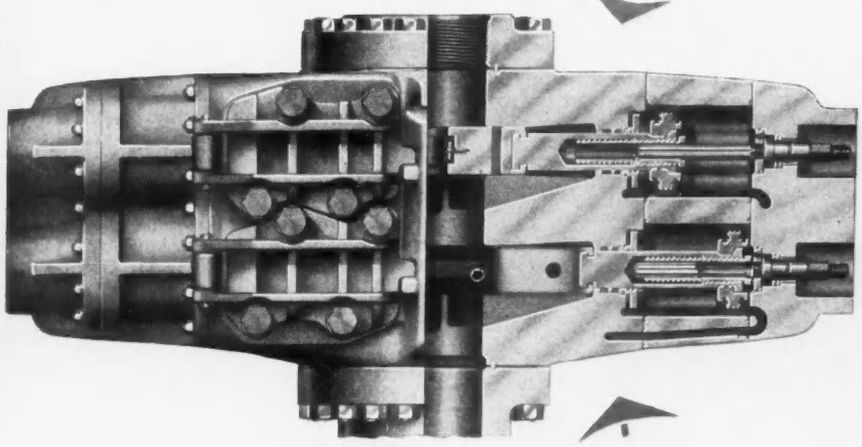
PEPA to Meet in Houston

The 23rd annual meeting of the Petroleum Electric Power Association will be held November 19-20 at the Shamrock Hotel, Houston.

In the Shaffer Hydraulic Cellar Control Gate

ALL MOVING PARTS ARE COMPLETELY ENCLOSED!

Take a look at the clean design of the new Shaffer Hydraulic Cellar Control Gate. Note how all operating parts are COMPLETELY ENCLOSED within the body of the Gate.



1 There are no outside moving parts to become corroded by chemical muds or salt fluids dripping into the cellar!

2 There is nothing to become wedged or jammed by falling objects or loose timbers in the cellar!

3 There are no exposed shafts where mud and grit can collect to be carried into packing units, score shafts, cause leakage and early failure!

- **No corrosion problems from chemical muds!**
- **No jamming or wedging by loose objects!**
- **Greater protection—greater safety—less maintenance!**

In fact, not only are all moving parts protected within the body of the Shaffer Hydraulic Cellar Control Gate, but even the locking shaft is non-rising and completely protected at all times!

What do these features mean? Simply this—that Shaffer engineers have designed the Shaffer Hydraulic Cellar Control Gate to be safety equipment *of the most advanced type*—with no operating parts exposed to the severe conditions and unpredictable elements found in rig cellars.

Nothing is left to chance. When pressure emergencies occur you can depend on this unit being ready for *fast* and *complete* closure without interference from any foreign material or objects outside the body—*because they simply cannot interfere with its operation!*

SHAFFER

HIGH PRESSURE DRILLING AND CONTROL EQUIPMENT • FISHING TOOLS THAT EXCEL

SHAFFER TOOL WORKS, Brea, California • California Service Shops: Santa Fe Springs and Taft
HOUSTON, TEXAS, 6006 Navigation Blvd. • ODESSA, TEXAS, 1925 West Second Street
OKLAHOMA CITY, OKLAHOMA, Acme Oil Tool Company, 1001 S. E. 29th Street
CASPER, WYOMING, Shaffer Tool Works, Post Office Box 1788
EXPORT SALES OFFICE: Shaffer Tool Works, 500 Fifth Avenue, New York, N. Y., U.S.A.

28 years OF OIL TOOL LEADERSHIP

And Don't Forget These 4 Other Vital Features, Too!

Complete protection of the operating parts is only one of many important features found in the Shaffer Hydraulic Cellar Control Gate. These are equally important—

▸ **SPACE SAVING COMPACTNESS:** Although *two* separate ram compartments are unitized in *one* body, the overall height of the Gate, including both compartments, is only 30" in sizes as large as 13⅜" (12" Series 900). Smaller sizes even less!

▸ **SIMPLE RAM CHANGES**—the simplest in *any* Gate. Just unbolt and swing open a side door, slide out the ram assembly, slide in the new assembly, close and bolt the door. It's as simple as that—*and complete ram changes can be made whether pipe is in or out of the hole!*

▸ **QUICK DRAINING BODY:** The rams travel on high narrow guide ribs raised above the steeply-sloped bottoms of the ram compartments. Mud and sand quickly drain back into the well—no detrimental accumulations to interfere with free ram operation!

▸ **DIRECT HYDRAULIC DRIVE:** Hydraulic operating cylinders are *directly behind* the rams for direct action, maximum simplicity, greatest safety. No secondary connections between hydraulic cylinders and rams!

And there are still other important features—all combining to make the Shaffer Hydraulic Cellar Control Gate the most advanced *hydraulic* gate available today. Get full details from your Shaffer representative—or write direct!

Write for the new 1950 Shaffer Catalog that gives full information on the Shaffer Hydraulic Cellar Control Gate as well as other Shaffer products.

See pages 4433 to 4496 of your 1950 Composite Catalog!

Chapman and Bradley Will Speak at API's 31st Meeting

Interior Secretary Oscar L. Chapman and General of the Army Omar N. Bradley are among the distinguished speakers who will address general sessions of the 31st annual meeting of the American Petroleum Institute in Chicago November 5-8.

Secretary Chapman, who is also Petroleum Administrator for Defense, will address the first general session, Wednesday morning. Also at this meeting will be a report of the board of councillors and election of directors. A highlight of the session will be presentation of the API "Gold Medal for Distinguished Achievement," the industry's highest award. API President Frank M. Porter will also speak at Wednesday's general session.

The address by General Bradley, chairman of the Joint Chiefs of Staff, is scheduled for the general session Thursday morning. Also on the program is a talk by Governor Allan Shivers of Texas, who is chairman of the Interstate Oil Compact Commission.

W. Alton Jones, president of Cities Service Company and API chairman, will preside at both general sessions.

Added to the 1951 program is a symposium on fundamental research on the occurrence and recovery of petroleum, a session scheduled for Monday morning, November 5. At this meeting will be reports by Dr. Robert E. Wilson, board chairman for Standard Oil Company (Indiana); C. E. ZoBell and F. P. Shepard, of Scripps Institution of Oceanography; B. H. Sage, of California Institute of Technology; and W. L. Whitehead, of Massachusetts Institute of Technology.

The **Division of Production** plans two group sessions, on Tuesday and Wednesday afternoons.

Presiding at Tuesday's Production session will be W. L. McCloy, Jr., Sohio Petroleum Company, Oklahoma City, and Glenn M. Stearns, British-American Oil Producing Company, Tulsa. M. G. Mayberry, Mellon Institute of Industrial Research, Pittsburgh, will report on two years of research on the development of an API thread compound. "Progress in Unitization" is the subject of a talk by H. H. Kaveler, Phillips Petroleum Company, Bartlesville, Okla. Paul D. Torrey, Austin, Texas, consultant, will discuss "Current Aspects of Some Important Water-Injection Projects."

API Certificates of Appreciation will be awarded at the Production session Wednesday. J. Terry Duce, Arabian-American Oil Company, New York, will talk on "The Outlook in the Near East," and C. E. Reistle, Jr., Humble Oil & Refining Company, Houston, will present a paper on "Importance of Technological Growth as a Contribution to U. S. Productive Capacity." R. O. Garrett, Arkansas Fuel Oil Company, Shreveport, and George E. Cannon, Humble Oil & Refining Company, Houston, will preside.

Three group sessions are scheduled by the **Division of Transportation**, which will have all its meetings in the Palmer House.

Papers to be presented at the Pipe Line Symposium Tuesday morning include "The Structural Design of Flexible Protective Casings for Pipe Lines," by M. G. Spangler, Iowa State College, Ames, Iowa; "Developments in Products Pipe Line Technology," by J. R. Shipley, The Standard Oil Company (Ohio), St. Louis; "Minimizing Pump Station Fire Hazards," by P. D. Phillips and F. O. Stivers, Humble Pipe Line Company, Houston; and "Can Contractors Discuss Pipe Line Construction Contracts?" by Richard A. Gump, Pipe Line Contractors Chapter of Associated General Contractors, Dallas. J. H. Peper, The Buckeye Pipe Line Company, New York, will preside.

Those attending the Pipe Line Symposium Tuesday afternoon will hear papers on "Developments in Automatic Gauging, Sampling and Testing Equipment," by F. H. Warren, The Ohio Oil Company, Findlay, Ohio; "Developments in Pipe Line Communications," by V. J. Sittel, Service Pipe Line Company, Tulsa; and "Cold Weather Pipelining," by T. S. Johnston, Interprovincial Oil Pipe Line Company, Toronto.

Addresses by Delos W. Rentzel, under-Secretary of Commerce for Transportation, James K. Knudson, administrator of

FISHIN'S much FASTER
WITH A
LEBUS
KNUCKLE JOINT
OVERSHOT SYSTEM
The LeBus Knuckle Joint—Overshot System is so efficient that by running the knuckle Joint above the Overshot on every fishing job, you are able to contact the fish quickly and at a minimum of expense. The FO-47 Knuckle Joint will help the Overshot Guide contact the fish quickly on the first run which is insurance against expensive cutting jobs. The cost of cutting a string of stuck pipe is often more expensive than the entire cost of one LeBus FO-47 Knuckle Joint. Have the LeBus Knuckle Joint always available on your derrick floor, and your regular driller becomes an expert fishing tool operator.
LESS EXPENSIVE
MORE EFFECTIVE
WRITE TODAY FOR
COMPLETE LITERATURE
LEBUS
LEBUS ROTARY TOOL WORKS
P. O. BOX 2352 LONGVIEW, TEXAS L. D. Phone 5

Longer service in corrosive wells with...

Sucker Rods of "K" Monel

"K"® Monel sucker rods have lasted for *years* in wells where other rods have failed in *weeks*.

In some of the most corrosive areas of West Texas, for example, "K" Monel rods have bucked a wide range of sour crudes and brines—*and won out every time.* (Three typical case histories are briefly reviewed in the panel at the right.)

"K" Monel, in addition to providing such high resistance to corrosive media, also resists abrasion and wear. It withstands stress, vibration and flow-cutting.

High Fatigue Strength

And "K" Monel has other important features, too. It can be used under the conditions existing in oil and gas wells without significantly accelerating corrosion of the steel equipment with which it comes in contact. Nor is its fatigue strength significantly affected by the presence of oil well corrosives.

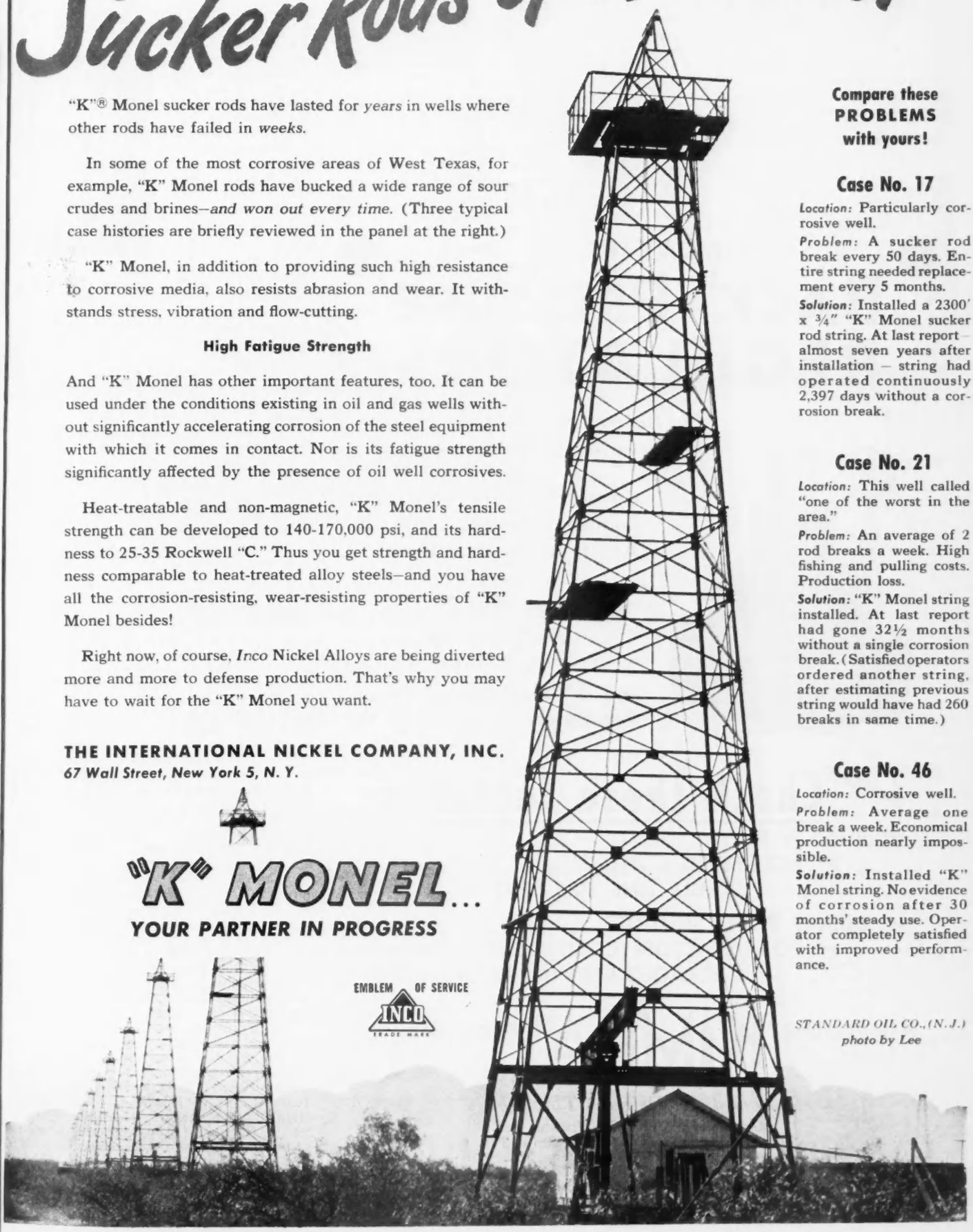
Heat-treatable and non-magnetic, "K" Monel's tensile strength can be developed to 140-170,000 psi, and its hardness to 25-35 Rockwell "C." Thus you get strength and hardness comparable to heat-treated alloy steels—and you have all the corrosion-resisting, wear-resisting properties of "K" Monel besides!

Right now, of course, *Inco* Nickel Alloys are being diverted more and more to defense production. That's why you may have to wait for the "K" Monel you want.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street, New York 5, N. Y.

"K" MONEL...
YOUR PARTNER IN PROGRESS

EMBLEM OF SERVICE
INCO
TRADE MARK



Compare these PROBLEMS with yours!

Case No. 17

Location: Particularly corrosive well.

Problem: A sucker rod break every 50 days. Entire string needed replacement every 5 months.

Solution: Installed a 2300' x ¾" "K" Monel sucker rod string. At last report – almost seven years after installation – string had operated continuously 2,397 days without a corrosion break.

Case No. 21

Location: This well called "one of the worst in the area."

Problem: An average of 2 rod breaks a week. High fishing and pulling costs. Production loss.

Solution: "K" Monel string installed. At last report had gone 32½ months without a single corrosion break. (Satisfied operators ordered another string, after estimating previous string would have had 260 breaks in same time.)

Case No. 46

Location: Corrosive well.

Problem: Average one break a week. Economical production nearly impossible.

Solution: Installed "K" Monel string. No evidence of corrosion after 30 months' steady use. Operator completely satisfied with improved performance.

STANDARD OIL CO., (N.J.)
photo by Lee

the Defense Transport Administration, and George A. Wilson, director, Supply and Transportation division, PAD, all of Washington, D. C., will highlight the Transportation Session Wednesday afternoon. Presiding officer T. E. Swigart, Shell Pipe Line Corporation, Houston, will present API Certificates of Appreciation at this session, and members of the Transportation Division's General Committee will be elected.

An interdivision symposium on the availability and procurement of steel for the oil industry is slated for Tuesday morning. B. B. Wescott, Gulf Research and Development Company, Pittsburgh, will preside.

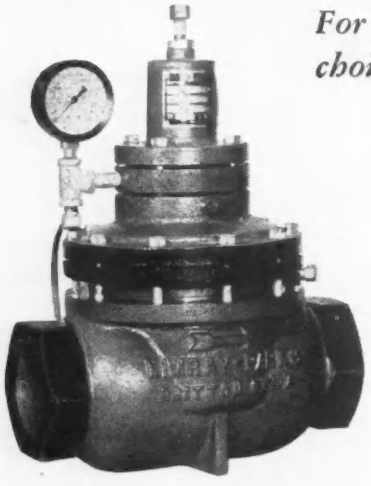
The Stevens Hotel will be general headquarters for the four-day meeting, and will house all general, group and committee sessions, except those of the Division of Transportation.

Many of the more than 100 committee sessions to be held during the annual meeting will get underway as early as Friday, November 2. Committee meetings will continue through November 8.

Other meetings held in conjunction with the API annual meeting will be the yearly dinners of the Transportation Club, the Pipeliners Club, and the 25-Year Club. The Association of Petroleum Writers also will hold its annual meeting and election of officers during the course of the API meeting.

KIMRAY-PARKS

BACK PRESSURE REGULATORS



PATENT PENDING

For the past five years the popular choice of oil field production men!

Convertible to Pressure Reducing Service Without Additional Internal Parts

. . . and . . .

IMMEDIATE DELIVERY ON

2", 3", 4" Screwed or Flanged, and 6" Flanged —— through distributors listed below.

Check these features:

- BUILT-IN PILOT
- NON-BLEED CONTROL
- SINGLE LINE SIZE SEAT
- BUBBLE TIGHT SHUT-OFF
- POSITIVE CLOSE CONTROL (No Hunting)
- PACKAGED UNIT (ready for the line)

MANUFACTURED BY KIMRAY INC. OKLAHOMA CITY U. S. A.

Immediate Delivery Through:

Merla Sales & Service Co., Houston, Tex.
Engineering Service Co., Corpus Christi, Tex.
Control Equipment Inc., Odessa, Tex.
A. L. Bethel, Graham, Tex.
Materials Service Co., Los Angeles, Calif.
Kimray, Inc., Oklahoma City, Okla.
Merla Sales & Service Co. (c/o Bill Ussury Tool Co.), New Iberia, La.

Thompson Is 1951 Recipient Of Institute's Highest Award

Lt. Gen. Ernest O. Thompson, long a member of the Texas Railroad Commission and one of the nation's foremost petroleum conservation experts, is the 1951 recipient of the American Petroleum Institute's "Gold Medal for Distinguished Achievement."

Ernest O. Thompson

W. Alton Jones, president of Cities Service Company and chairman of the API board, will make the presentation to General Thompson Wednesday, November 7, in Chicago at the API meeting.

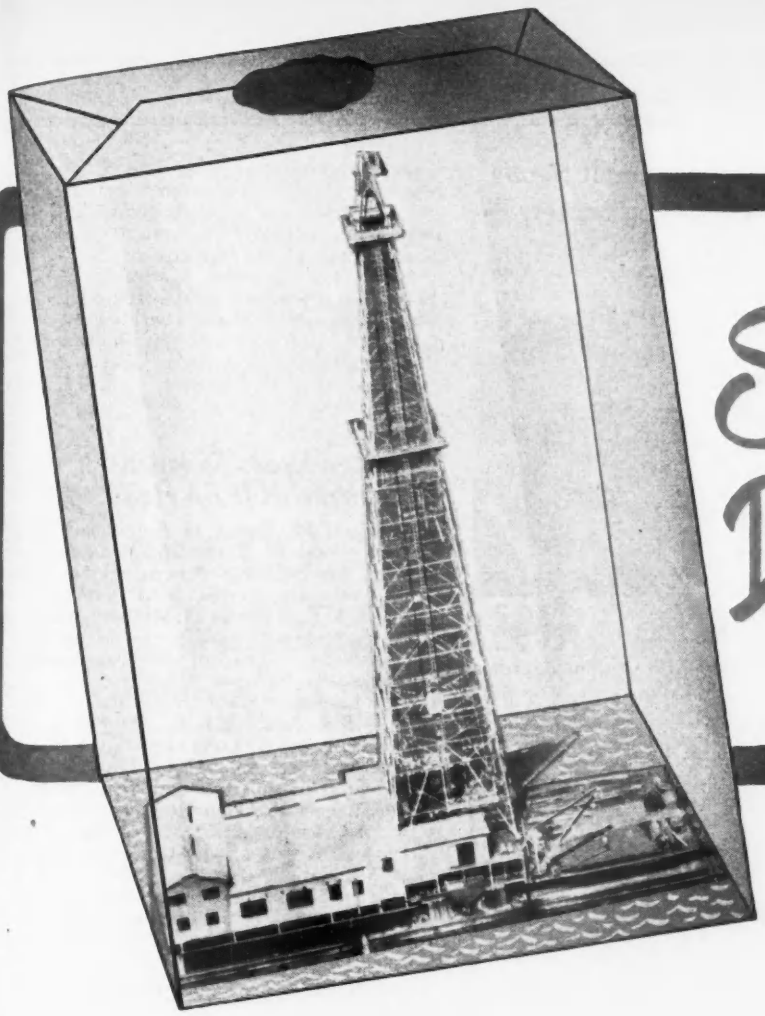
General Thompson, soldier, lawyer, petroleum expert and public official, since 1932 has been a member of the Railroad Commission, the regulatory body for the oil industry in Texas. He has exercised a tremendous influence in the development of conservation policies to protect oil reserves, and was a founder of the Interstate Oil Compact Commission.

API Appreciation Certificates Awarded to 13 Production Men

More than 2¾ centuries of service to the oil industry are represented by the 13 men who will receive Certificates of Appreciation at the November 7 group session of the API Division of Production.

Recipients of the awards will be: **R. L. Wheelock**, Wheelock and Collins, Corsicana, Texas, who has been a member of the API board of directors continuously since 1938, and vice president for production and chairman, General Committee of the Division of Production, in 1949 and 1950; **R. B. Kelly**, The Pure Oil Company, Fort Worth, for conspicuous and constructive work on the vocational training program, district activities, and work in drilling and production; **A. C. Rubel**, Union Oil Company of California, Los Angeles, for constructive cooperation in the affairs of the Division of Production; **A. W. Thompson**, Thompson-Carr, Inc., Houston, for active and constructive cooperation in forwarding the work of the Division of Production; **C. D. Watson**, formerly with The Carter Oil Company, Tulsa, for long and faithful service to the API's standardization program, as well as activities in the drilling and production practice group; **Blaine B. Wescott**, Gulf Research and Development Company, Pittsburgh, for constructive and conscientious service and cooperation in the work of the Division of Production.

The seven who will receive certificates for "long and faithful service to the Institute's standardization program," are **D. O. Barrett**, retired, formerly with Gulf Oil Corporation, Tulsa; **D. R. Dale**, The S. M. Jones Company, Toledo; **C. A. Dunlop**, Humble Oil & Refining Company, Houston; **T. C. Ervin**, Lucey Boiler and Manufacturing Company, Chattanooga; **Glenver McConnell**, retired, formerly with Shell Oil Company, Tulsa; **Turner C. Smith**, General Petroleum Corporation, Los Angeles; **C. R. Weiss**, Link-Belt Company, Indianapolis.



Submersible Drill Barges-

"A COMPLETE PACKAGE"

BY

Levingston

From crown block to barge bottoms, Levingston is prepared to accept the entire responsibility of constructing and rigging-up your submersible drill barges on a turn-key basis. You select the tools, or equipment, and Levingston's experienced organization will install them for safe and efficient operation on marine locations.

Levingston

SHIPBUILDING COMPANY • ORANGE, TEXAS

SAVE "DOWN TIME" ON MARINE DRILLING EQUIPMENT REPAIRS

SOUTH TEXAS NATIONAL BANK OF HOUSTON

Oil Production Loans

Complete services for all phases of the oil industry. Include us in your financing plans.

SOUTH TEXAS NATIONAL BANK

213 MAIN STREET • HOUSTON, TEXAS

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

Fort Worth Independent Heads Texas Mid-Continent Society

Robert F. Windfohr, Fort Worth independent oil producer, has been elected president of the Texas Mid-Continent Oil & Gas Association. Windfohr, who succeeds R. B. Anderson of Vernon, Texas, is the 13th Texas oil man to head the association.

R. F. Windfohr

Harry W. Bass, of the Harry Bass Drilling Company, Dallas, was chosen vice president in charge of the association's new North Central Texas District. Bass is a director of the Texas Mid-Continent group, and also of the INGAA. He is a member of IPAA.

Windfohr is a partner in the oil firm of Nash and Windfohr, and also Nash, Windfohr and Brown. Before World War I, he was admitted to the Maryland bar, following studies at the University of Maryland. At war's end, he formed a partnership with James P. Nash, Austin oil operator. Long active in petroleum industry problems, Windfohr was a member of the original committee of 55 oil men who championed the state conservation laws at the time of their initiation in the thirties.

Geologist DeGolyer Is Honored By AIME's Petroleum Branch

Dr. E. L. DeGolyer, world renowned geologist who heads the firm of DeGolyer and MacNaughton, Dallas, has been elected to honorary membership in the American Institute of Mining and Metallurgical Engineers. Only 20 men may hold that honor at one time.

Dr. DeGolyer, who has located oil production in most important areas of the Western Hemisphere, discovered Mexico's Potrero del Llano 4 in 1909—a discovery which alone has produced more than 100 million barrels of oil.

In 1919 he organized Amerada Petroleum Corporation and in 1925 its subsidiary, Geophysical Research Corporation. He served for a number of years as president of the two firms as well as chairman of the board of the former.

In 1914 he became a member of the Petroleum division of AIME. His contributions to this scientific-engineering organization have been his service as chairman of the Petroleum division from 1923 to 1925, as president of the institute in 1927 and as a director in 1928 and 1929.

Charlton Lyons Succeeds Ed Warren as IPAA Head

Charlton H. Lyons of Shreveport was elected president of the Independent Petroleum Association of America last month at the annual meeting in Houston. He succeeds J. Ed Warren of Midland, Texas, who was presented a plaque in recognition of his service as head of the organization.

Lyons was born in Abbeville, La., attended Louisiana State University, and received B.A. and L.L.B. degrees from Tulane University. Long active in industry affairs, he has served IPAA both as vice president for Louisiana and as a member of the Executive Committee. He also has served as vice president of the Louisiana-Arkansas Division of Mid-Continent Oil & Gas Association. He is a diligent civic worker in Shreveport and is secretary and a member of the board of trustees of Centenary College.

Standardization Meeting Set

The 1952 Midyear Standardization Conference of the API Division of Production will be held at the Brown Palace Hotel in Denver, June 9-14.

IOCC Sets Winter Meeting

Little Rock, Ark., will be the site of the winter (annual) meeting of the Interstate Oil Compact Commission, to be held December 11-12, with the Hotel Marion as meeting headquarters.

PESA Directors to Meet

The annual meeting of the directors of Petroleum Equipment Suppliers' Association will be held Monday, November 5 at the Palmer House Hotel in Chicago.

Councillors and Officers of the Pacific Chapter of the AIME Petroleum Branch are pictured at the chapter's fall meeting. Seated are R. L. Parsons, J. S. Baker, and W. E. Glenn. Standing are C. R. Dodson, Paul Andrews, K. E. Barley, F. L. Wadsworth, H. E. Nissen, M. E. Loy, L. W. Chasteen and B. P. Kantzer.

Industry Comes to Aetna for two important reasons :

TO SAVE MAN HOURS, MACHINE HOURS AND MONEY

TO HELP GET THINGS DONE

Today the pressure for production is on. The welfare of our economy —or of an individual business—may depend upon a deeper search for time and money-saving methods.

Take your own plant, for example. Maybe there's a lot you could save—some bottlenecks you could break—by letting Aetna fabricate certain of your assembly parts . . . to your most exacting metallurgical, uniformity and tolerance specifications. You'll avoid troublesome raw material procurement problems, decrease the burden on over-loaded equipment, save man-hours and very likely reduce the delivered cost of your product to boot.

Aetna's mobilized facilities include the most modern equipment for stamping, piercing, machining, heat treating, ultra precision finish grinding plus complete engineering assistance, extensive tool and die facilities and over 35 years experience in serving leading manufacturers in the Automotive, Agricultural Equipment, Oil Field Equipment and General Industrial Fields.

NOW is a good time for YOU to find out how Aetna can help with your parts problems as well as your bearing problems. Write today!

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Standard and Special Ball Thrust Bearings • Angular Contact Ball Bearings • Special Roller Bearings • Ball Retainers • Hardened and Ground Washers • Sleeves • Bushings

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Here's the gift you've been looking for . . . hand engraved sterling silver money clip, with 10 carat gold raised surface derrick . . . signet on the back for your initials . . . the practical gift for your "oil country" friends. Send check or money order to—No C.O.D.:

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Arch H. Rowan

J. A. Neath

Neath and Rowan Receive Top Awards of Texas Oil Industry

Arch H. Rowan, Fort Worth independent operator, and J. A. Neath, Houston, vice president of Humble Oil & Refining Company, received Distinguished Service Awards at the 32nd annual meeting of the Texas Mid-Continent Oil & Gas Association in Beaumont.

The award plaques are presented every year to an independent and a representative of a major company who have made outstanding contributions to the industry. Both 1951 award holders have been actively engaged in association and industry-wide activities for many years.

Following a tour of roughnecking in the oil fields, Rowan formed the Rowan Drilling Company in 1924. He is now chairman of the board of that company in addition to being president of Rowan Oil Company. During World War II, Rowan was a member of the Petroleum Industry War Council and served on its Manpower Subcommittee. He is a director of the Fort Worth National Bank.

After holding several pipe line jobs, Neath became a district foreman in the booming Ranger area before joining Humble in 1919. He became general superintendent of Humble Pipe Line Company at the age of 28. Neath became a director of Humble Pipe Line Company and later was elected a vice president. He resigned in 1942 to become a director of Humble Oil & Refining Company and was elected a vice president of the company in 1947.

McGee Will Act as Chairman of Coastal Engineering Conference

Dean A. McGee, executive vice president of Kerr-McGee Oil Industries, Inc., is chairman of the second annual National Conference on Coastal Engineering at Houston November 7-10.

Attorney General Price Daniel of Texas will speak on a phase of the tidelands question at the dinner November 7. Other speakers at the conference include authorities on coastal engineering, oceanography and meteorology.

The conference is sponsored by Southwest Research Institute. Charles E. Balleisen is conference secretary.

Pacific Geological Groups Hold Los Angeles Meeting

The 28th annual joint meeting of the Pacific sections of the American Association of Petroleum Geologists, the Society of Exloration Geophysicists, and the Society of Economic Paleontologists and Mineralogists is being held November 1-2 at the Ambassador Hotel, Los Angeles.

Joe B. Hudson is general chairman of the Convention Committee.

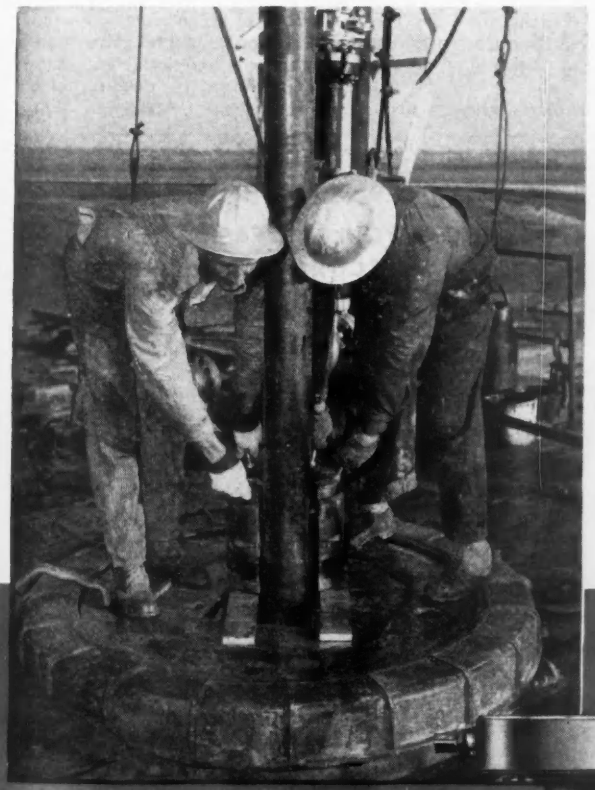
Research Director Appointed

James V. McGoodwin, a former executive with Hughes Tool Company, Houston, and associated with Paul G. Hoffman on the Committee for Economic Development, has been appointed director of the Institute of Inventive Research, San Antonio.

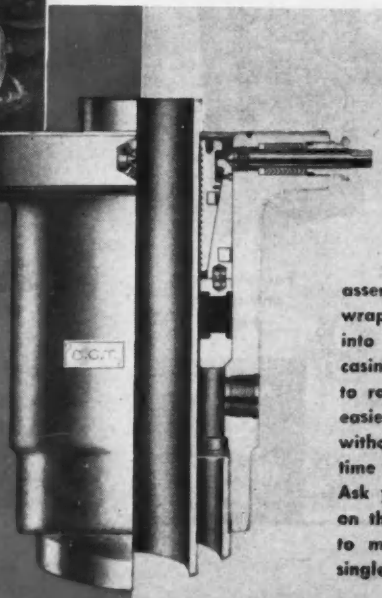
Early Risers are these members of the Women's Oil Association of Oklahoma City, and Bob Featherston, Knasas-Oklahoma Representative of the Oil Industry Information Committee. They are shown just before they boarded buses that took them on their Oil Progress Week inspired tour of the Elk City field and the new processing and gas cycling plant.

WHAT COULD BE EASIER?

. . . than taking candy from a baby or installing a casing hanger from the derrick floor!



O-C-T "C-19" CASING HEADS HAVE SET A NEW *SAFETY STANDARD* for RIGS AND CREWS



When it arrives at your rig, the O-C-T "C-19" Casing Hanger has been pre-assembled and is ready to install from the derrick floor. So, instead of seven separate pieces to "juggle" and install when hanging pipe, the sealing element, slip bowl and slips in the "C-19" are assembled as a single unit that may be quickly wrapped around the casing, latched and dropped into place in a jiffy. The seal is automatic when casing weight is applied; thus, elevators are released to raise blowout preventers. Now, what could be easier? All the work is done from the derrick floor without leaving any remote possibility open at any time for your well to pressure up and blow out. Ask your O-C-T Representative or write for details on the "C-19" . . . the first slip type casing head to meet every well completion condition with a single compact model!

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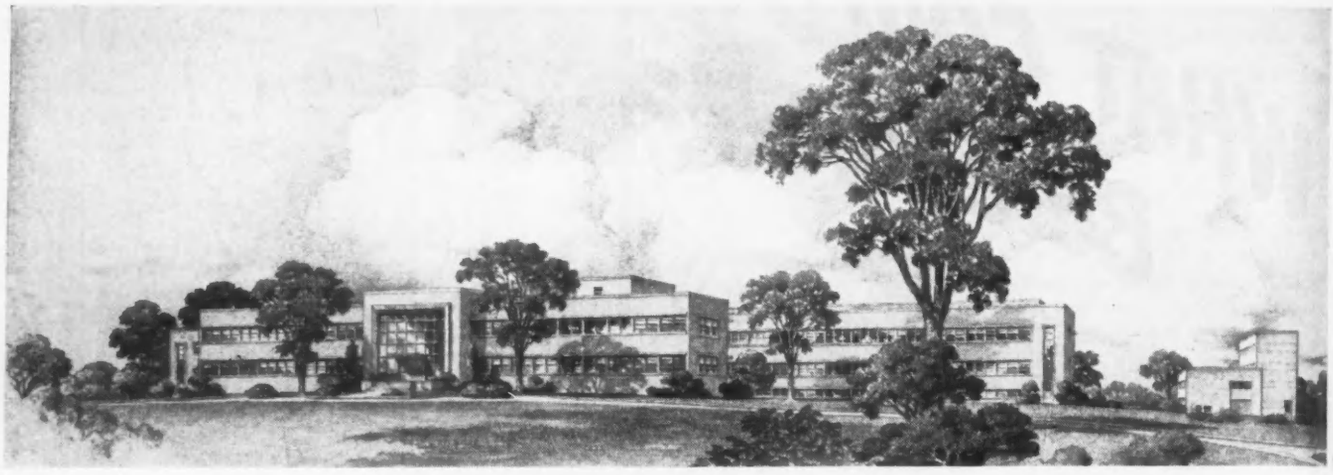
Canada — Canadian-Vickers, Montreal, Canada

Sterling Areas — Le Grand, Sutcliff & Gell, Ltd., Southall, Middlesex, England. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston 1, Texas.

Companies in the News



Artist's sketch of the main buildings of Stanolind's new research center in Tulsa

STANOLIND OIL AND GAS COMPANY has received PAD authorization to begin construction of its new research center in Tulsa. The center, which will house exploration, production, and synthetic fuels and chemicals research facilities, will be built on an 80-acre tract at 41st street and Yale avenue.

When the center is completed in about 18 months, virtually all of Stanolind's research and technical service activities will be transferred from the present laboratories at 1136 North Lewis avenue. The present buildings will be used chiefly for the manufacture of field geophysical equipment and routine testing and analysis work.

Besides the offices and laboratories, the new center will include a large conference room, cafeteria, library, garage, stockrooms and precision instrument shops.

Stanolind's research department, headed by George Roberts, Jr., manager, employs more than 425 people. Daniel Silverman is head of exploration research, and Lloyd E. Elkins is in charge of production research.

here it is... the New BJ PYRAMID TOOTH tong die

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WILL NOT CHIP

BJ's exclusive Selective Hardening process provides shock-absorbing core and ends plus super-hard teeth.

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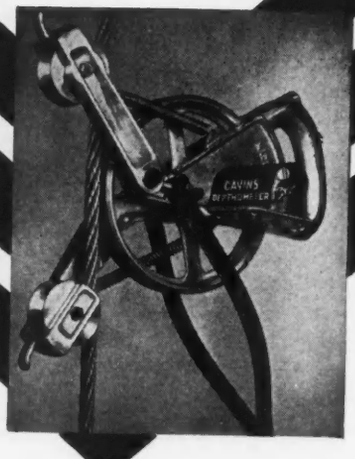
NOW YOU CAN EASILY TAKE ACCURATE WIRE LINE MEASUREMENTS



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will tell you where bottom is in little more time than it takes to make a trip with your bailer. Gives you accurate depth in plain figures—compensates for raising and lowering tools when feeling for bottom. Strong, light-weight, easily used, and priced right. Send today for illustrated folder.

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Value
Service

Thermoid Trioflex Rotary Hose makes new friends among old timers

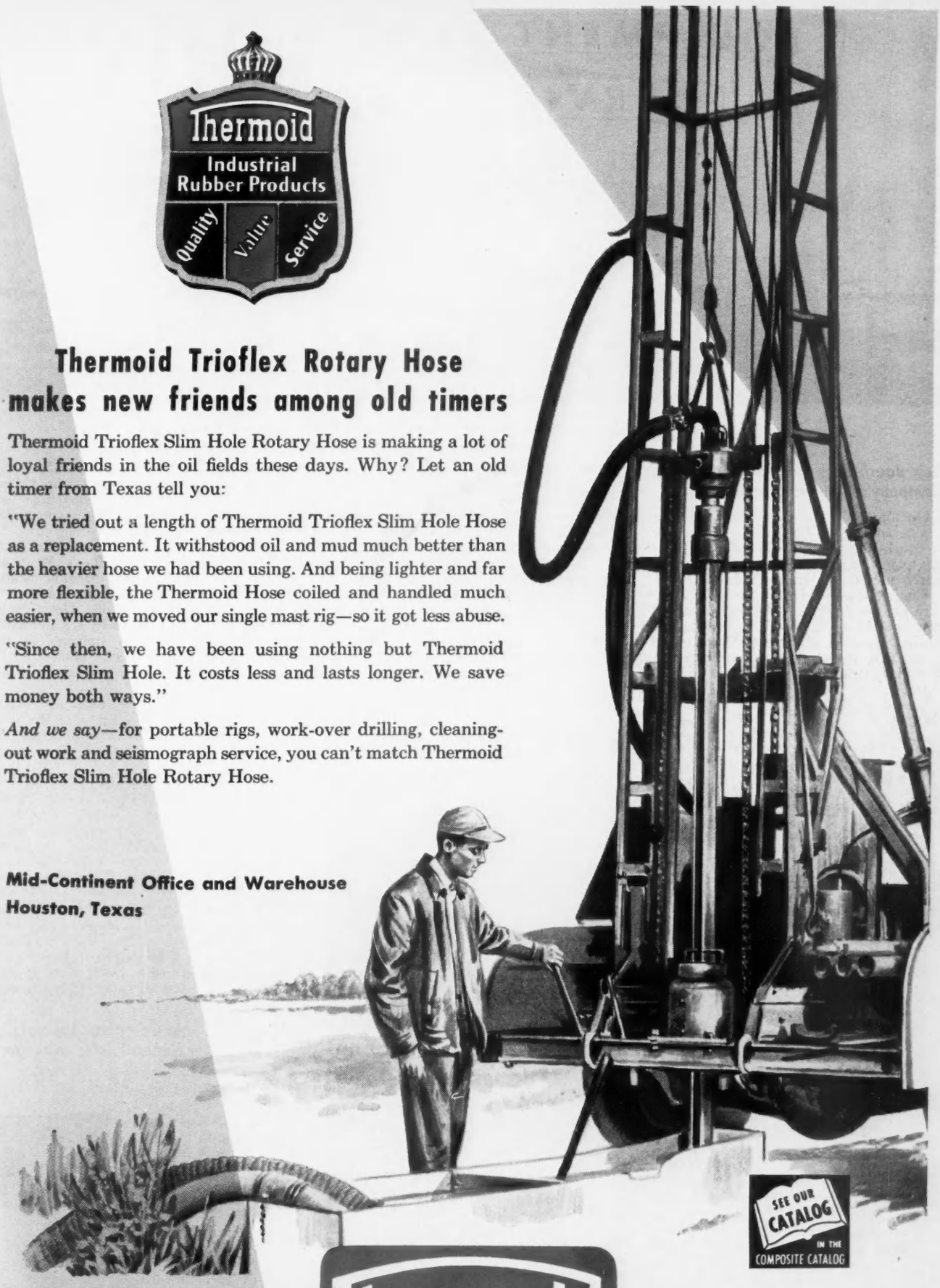
Thermoid Trioflex Slim Hole Rotary Hose is making a lot of loyal friends in the oil fields these days. Why? Let an old timer from Texas tell you:

"We tried out a length of Thermoid Trioflex Slim Hole Hose as a replacement. It withstood oil and mud much better than the heavier hose we had been using. And being lighter and far more flexible, the Thermoid Hose coiled and handled much easier, when we moved our single mast rig—so it got less abuse.

"Since then, we have been using nothing but Thermoid Trioflex Slim Hole. It costs less and lasts longer. We save money both ways."

And we say—for portable rigs, work-over drilling, cleaning-out work and seismograph service, you can't match Thermoid Trioflex Slim Hole Rotary Hose.

Mid-Continent Office and Warehouse
Houston, Texas



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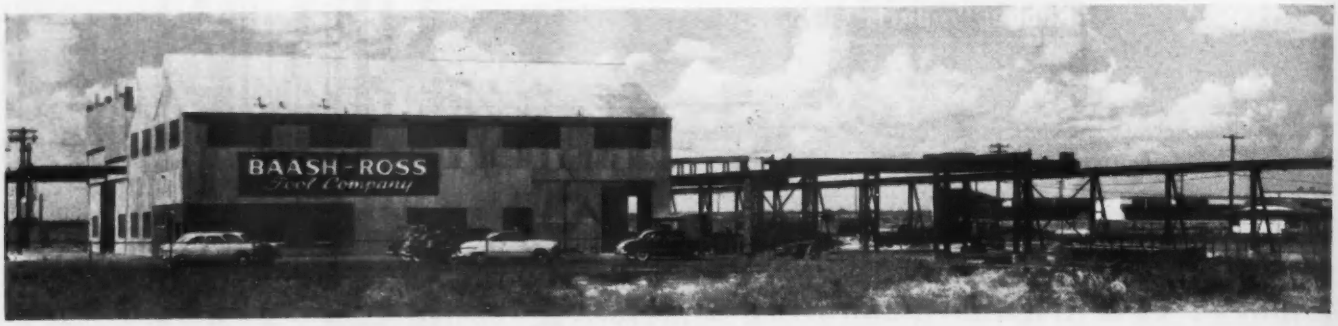
EQUIPMENT AND SERVICE SUPPLIERS' NOTES



Baash-Ross Tool Company's new manufacturing plant, maintenance shop and warehouse at Odessa, Texas.

New Baash-Ross Plant at Odessa Is Company's 17th Field Installation

Opening of its large new plant at Odessa, Texas, adds the 17th link to the network of Baash-Ross Tool Company manufacturing plants, maintenance shops and field warehouses in major oil fields.

The Odessa plant, situated on a five-acre site on Andrews Highway about 2½ miles north of the town's central business district, provides about 46,000 square feet of working area under roof and craneway. The plant structure has four bays and three craneways, one of which is 460 feet long, with a 60-foot span.

The complete range of heavy-duty machine tools installed in the plant includes thread mills, turret lathes, hollow spindle lathes, engine lathes, radial drill press, milling machine, shaper, hydraulic straightener and cylinder boring machine, together with accessory machines and equipment, as well as heat-treating facilities.

In addition to facilities for handling regular oil field equipment, special arrangements have been made to handle unusually long and heavy items such as drill collars, kellys and similar equipment. Plant design and arrangement of machine tools have been worked out to accommodate these items.

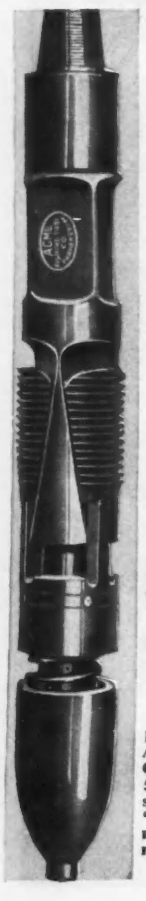
Also installed at the new plant is the newly-developed Baash-Ross Pressure Welding machine which permits welding drill collars together without addition of foreign metal of any kind. The Pressure Welder accomplishes this by a combination of low heat and high pressure so that the portions to be joined "flow" together in what is technically known as "solid phase" welding.

The cylinder boring machine installed in the new plant, together with the other machine tools, makes it possible for the Odessa plant to handle all types of gas engine repair work.

In addition to manufacturing and machine shop facilities provided by the new installation, it will also serve as headquarters for Baash-Ross sales and fishing tool operations in the West Texas and New Mexico areas.

L. L. (Red) Garren, Baash-Ross district manager for West Texas and New Mexico, is in charge of the new plant, while supervision of field and plant operations under him are handled by Phil Gibbons, district sales manager; Carl Prichard, district service manager; Gordon Ford, plant superintendent, and Jess Moody, office manager.

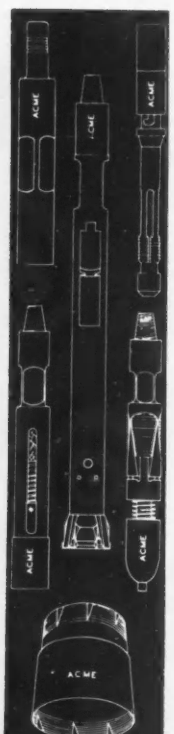
"The Greatest Name in Cable Tools"



Acme

TRUSTWORTHY SINCE 1900

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION MEMBER



. . . to-be-Sure — Always Ask for Acme's Trip Spear . . .

In scarce, hi-cost pipe times, Acme's Trip Casing Spear is a "jackpot." Does its pipe-recovery job easier, quicker, conservingly. . . . Vital parts, ALLOY steel. Full circle hitch, prevents oblonging when jarring. Long slip seats and finger-trip ring assure breakless slips. Quick-setting, positive action tripping device, for various pipe weights.

Acme Casing Spears are STANDARD with 100's of the top-flight Drillers. Life-time field-work of our own fishermen assures EXTRA inner-stamina so essential to long, hard field service. Their every detail confirms Acme's priceless tradition for: PREMIUM grade steel, CORRECT heat-treatment and unmatched tool CRAFTSMANSHIP.

See Acme's Insert in 1951 Composite Catalog. Also write for more complete Catalog, containing valuable cable tool "use and care" manual.

Fig. 247 — Acme Trip Casing Spear. 51-years' specialized "know-how" makes it worth more to YOU.

ACME DRILLING & FISHING TOOLS

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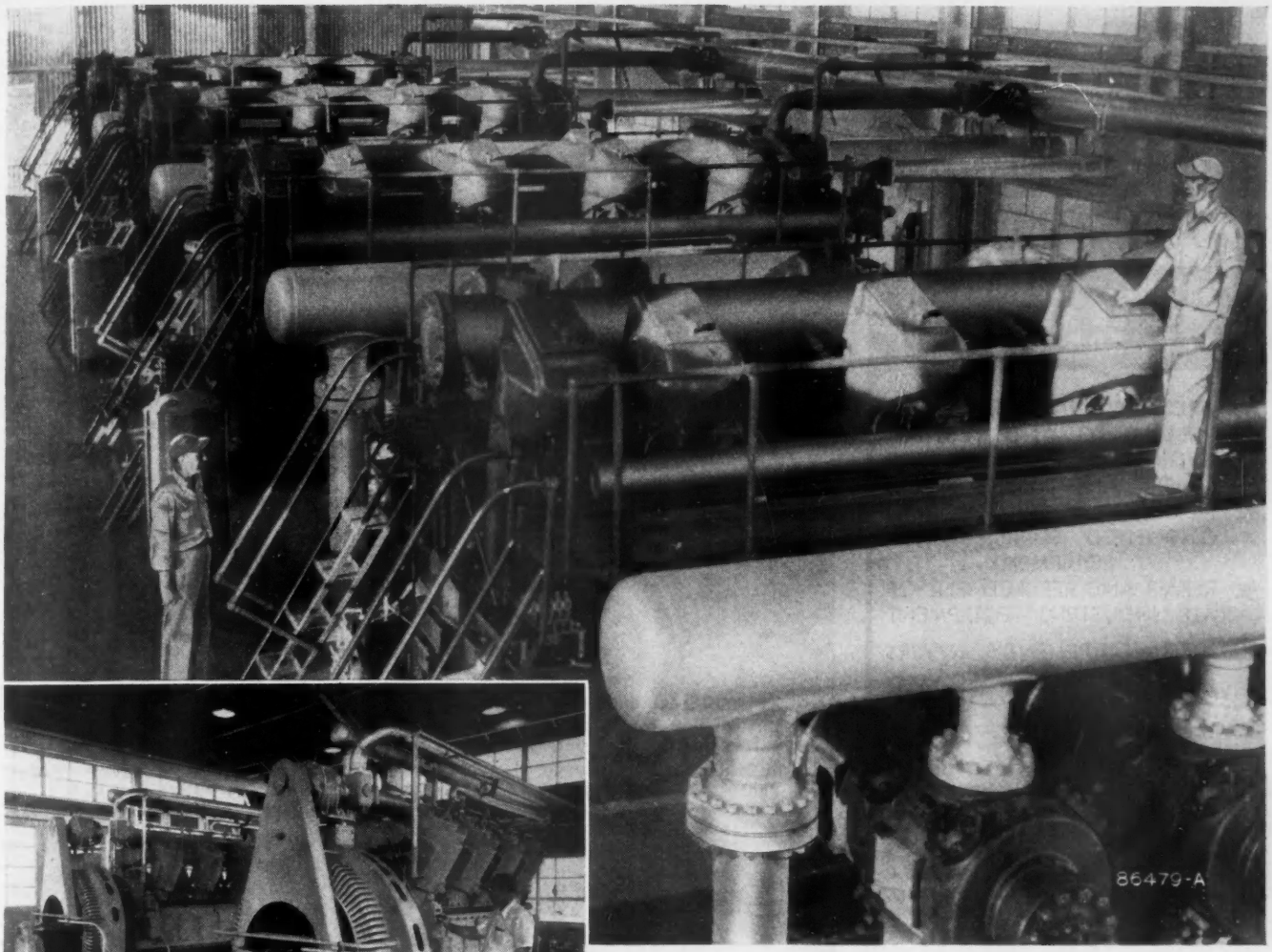
Whitney Chain Company Appoints H. W. Beder General Sales Manager

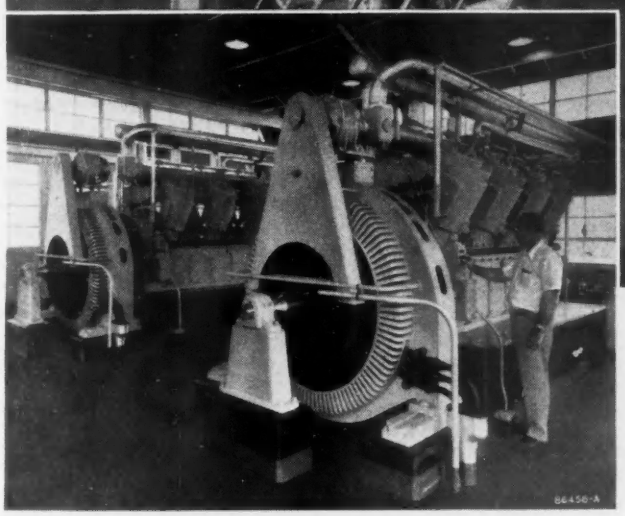
Harold W. Beder, Jr., has been appointed general sales manager of Whitney Chain Company, Hartford, Conn., according to an announcement by Winthrop H. Whitney, president.

Harold W. Beder, Jr.

Beder was formerly with McKinsey Company, management consultants, New York, as market research specialist. During World War II he served as commander in the Navy during a five-year tour of duty.

Beder's previous business associations included Procter & Gamble, a gardening magazine (as owner and publisher), and John Wanamaker.





Four Ingersoll-Rand 1320-hp Type KVG Compressors at Slaughters, Kentucky, station.

Two 406-hp Type PVG Gas Engine Generator units at Jeffersontown, Kentucky, station.

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on Texas Gas Transmission Corp. Line

A number of stations on the 800-mile Texas-to-Ohio line are served by INGERSOLL-RAND Type KVG Gas Engine Compressors, and Type PVG Gas Engine Generator Sets. This line with a capacity of approximately 400 million cubic feet per day serves customers in seven states.

You will find these INGERSOLL-RAND heavy-duty engines and compressors serving all types of petroleum projects, pipe lines, refineries, gasoline plants, repressuring, gathering, etc. For full information contact the nearest Ingersoll-Rand Branch office.

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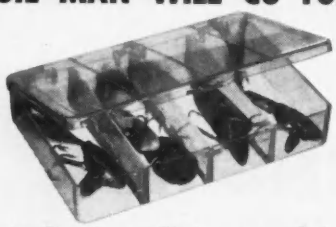
A FISHING JOB THE OIL MAN WILL GO FOR



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Four Beautiful Di-Dipper Lures with Feathered Streamers, neatly packed in a sectional, hinged-top plastic box.

These baits are designed to catch fish—not fishermen.

$5.00 per set

Three sets for only $14.00. Additional discounts on larger quantities.

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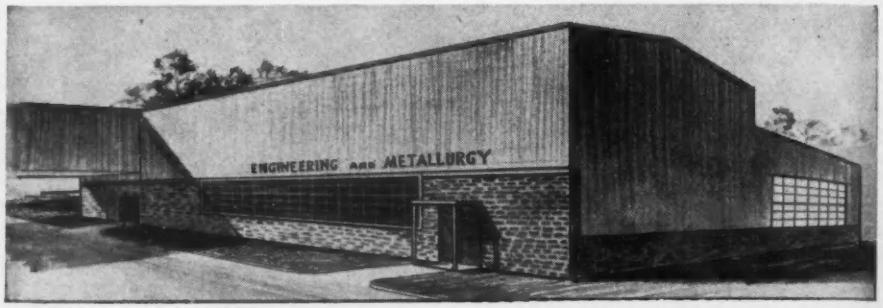
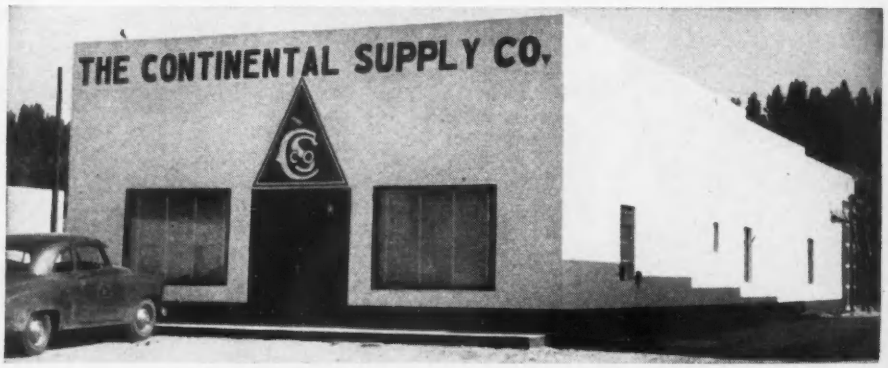


This New Engineering and Metallurgical Building for Cameron Iron Works is now under construction in Houston. The structure will house offices, drafting rooms and laboratories. The upper floor connects with the general office building by means of an overhead concourse wherein are also located the blueprint and photostat department.

Ready for Business are store personnel at Mid-Continent's new Sterling, Colo., store. Left to right are H. D. Weaver, storeman; H. T. Branum, field salesman; S. A. Worrall, store manager; W. E. Phillips, storeman, and W. L. Ross, storeman. Not shown in the picture is J. D. Bell, field salesman, who has been transferred from the Casper, Wyo., store.



Farmington, N. M., Is the Site of this new Continental Supply Company store, which will serve northwestern New Mexico, southwestern Colorado and southeastern Utah. C. A. Ross is manager of the store.

Rolo Manufacturing Company has promoted three men to major positions in the firm. Pictured with H. Vernon Smith, general manager (second from left) and R. K. (Bob) Franklin, founder and owner (center), are, left to right, James L. Kepple, the new assistant general manager; W. M. Boren, chief engineer; and R. G. Oliphant, assistant general manager.

ALDRICH WAS FIRST!

to produce high speed pumps with crankshaft speed of 120 rpm (1918)

to develop porcelain plungers

to develop the Variable Stroke Triplex Pump (1926)

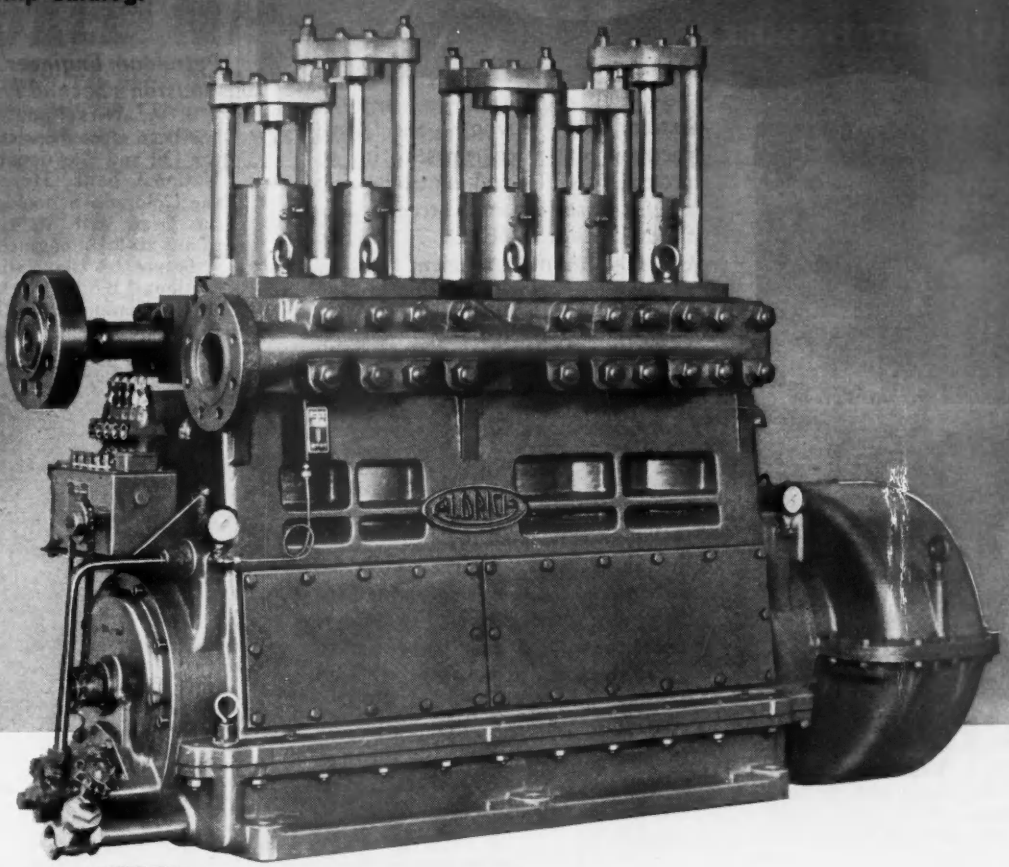
to build 5, 7, and 9-plunger pump units

to perfect the Aldrich-Groff "Powr-Savr" Controllable Capacity Pump (1939)

to advance crankshaft speeds to 225 rpm (1939)

and (1949) to design and produce the Direct Flow Pump: a pump with a "straight line" fluid-end, of sectionalized construction . . . available in the following stroke sizes: 3" at 500 rpm, 5" at 360 rpm, and 6" at 300 rpm . . . applicable for: water flooding, water disposal, pumping lean oil to absorbers, and the handling of diethylene glycol, gasoline, propane, butane.

Today—to bring your files up-to-date—request the Aldrich Direct Flow Pump Catalog.



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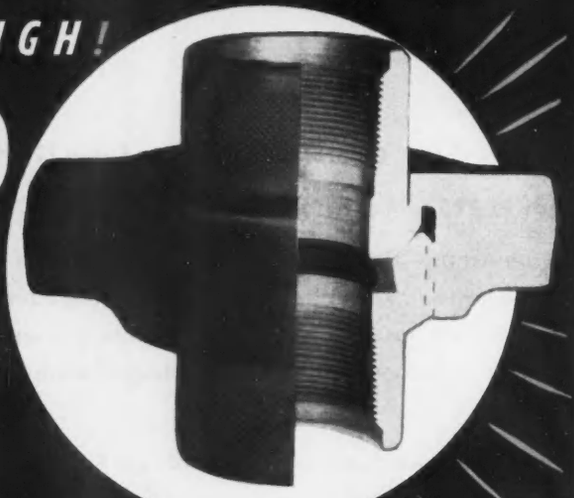
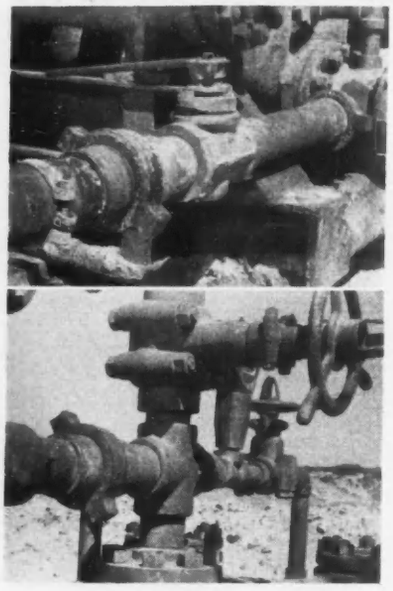
Where PRESSURES ARE HIGH — Where CLEARANCES ARE LIMITED — Where JOBS ARE ROUGH!

WECO FIG. 602 UNION

6000 LBS. TEST PRESSURE





Four inch, 6,000 lb. WECO Fig. 602 UNIONS on a mud pump discharge line. Their fast make-up, easy break-out and perfect sealing make them the ideal union for this service.

Extraordinary strength and compactness, plus a resilient seal ring to protect the metal-to-metal seat against abrasive and corrosive line fluids makes WECO FIG. 602 UNION the most efficient solution to manifolding and close coupled connections on high pressure lines. Wall sections of the forged steel sub ends are shorter and stronger . . . the forged steel wing nut is tougher . . . the resilient seal ring has been proved in service up to 15,000 lbs. In addition, it has all the WECO features of perfect sealing, fast make-up, easy handling heavy acme threads. It is available in sizes 1" through 4" with sub ends threaded or bored for welding. Fig 602 is ideal for welded installations, since the resilient seal ring can be replaced without cutting off the sub ends. Ask your Weco Representative for further information about the Fig. 602. ALWAYS ASK YOUR SUPPLY STORE FOR WECO UNIONS.

WELL EQUIPMENT MFG. CORP.
Subsidiary of Chiksan Company
HOUSTON 1, TEXAS
Exclusive Sales Representative Outside Mid-Continent Area
CHIKSAN COMPANY
Brea, Calif. Chicago 3, Ill. Newark 2, N. J.
Export Sales: CHIKSAN EXPORT COMPANY, Brea, Calif. Newark 2, N. J.

WECO

Manufacturers and Distributors of Oilfield, Refining, Marine and Industrial Equipment

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Ross R. Chenault

D. T. O'Connor

O'Connor Is Named Eastern Agent For Mud Products Equipment Line

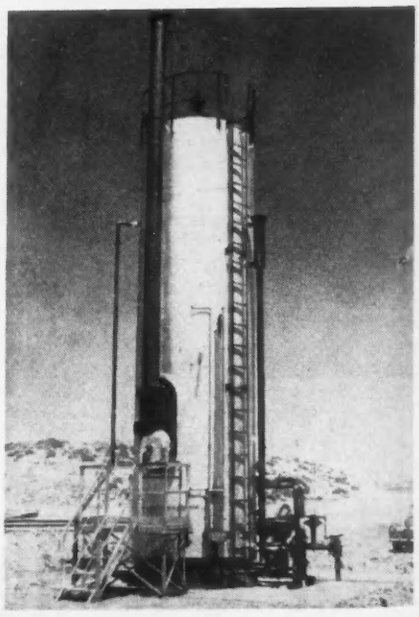
D. T. (Mickey) O'Connor, 500 Fifth Avenue, New York City, representative of several drilling and pipe line specialty companies, has been appointed exclusive sales representative of Mud Products, Inc., Tulsa, for eastern seaboard sales. O'Connor will also represent Mud Products for export sales. He will handle Mudco butterfly valves, mud tanks and ditches.

Associated with O'Connor is Ross R. Chenault, formerly with Trinidad Leaseholds, Ltd., in Trinidad.

Petroleum Engineer Is Elected by Houston's Second National Bank

S. A. Wickstrom, petroleum engineer, has been elected assistant vice president in the Oil and Gas department of the Second National Bank, Houston. A graduate of the Colorado School of Mines, Wickstrom has been with the bank for five years as a petroleum engineer.

Before his association with the Second National Bank, Wickstrom was assistant division engineer in the Houston office of Stanolind Oil and Gas Company.



This "National" Oil Treater, now in service, was manufactured for National Tank Company, Tulsa, by Standard Iron and Engineering Works Ltd., Edmonton, Alberta, a subsidiary of Dominion Bridge Company Ltd. The Canadian firm has fabricated more than 60 treaters of various sizes.

AVONDALE ... for the OIL INDUSTRY

You know what the word, "Integrity" means! Now apply it to a marine industry such as AVONDALE. It acquires many meanings, among which are: the absolute honesty of skilled experience, the "know-how" of people who understand and feel an interest in your particular problem. That's why AVONDALE has been so successful in building and repairing for the Oil Industry. . . . Integrity—all around!

Drilling Rig built for Rowan Drilling Company, Inc.

"Barnacle Bill", a radar-equipped crew boat designed for oil field work.

AVONDALE MARINE WAYS, Inc.

RIVER FRONT, NEW ORLEANS DISTRICT — MAIN PLANT, AVONDALE, LA.
Telephones: UNiversity 4561, CHestnut 5853 — QUICK-REPAIR PLANT, HARVEY, LA.
MAILING ADDRESS: WESTWEGO, LOUISIANA

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Comfortable Rooms

Delicious Meals

Conveniently Located in 21 Prominent Cities

Superb Service

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ALABAMA
HOTEL ADMIRAL SEMMES.....Mobile
HOTEL THOMAS JEFFERSON..Birmingham

DISTRICT OF COLUMBIA
HOTEL WASHINGTON.....Washington

INDIANA
HOTEL CLAYPOOL.....Indianapolis

LOUISIANA
JUNG HOTEL.....New Orleans
HOTEL DESOTO.....New Orleans

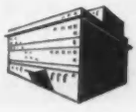
NEBRASKA
HOTEL PAXTON.....Omaha

NEW MEXICO
HOTEL CLOVIS.....Clovis

SOUTH CAROLINA
HOTEL WADE HAMPTON.....Columbia

TEXAS
HOTEL STEPHEN F. AUSTIN.....Austin
HOTEL EDSON.....Beaumont
HOTEL BROWNWOOD.....Brownwood
HOTEL BAKER.....Dallas
HOTEL TRAVIS.....Dallas
HOTEL CORTEZ.....El Paso
HOTEL BUCCANEER.....Galveston
HOTEL GALVEZ.....Galveston
HOTEL JEAN LAFITTE.....Galveston
CORONADO COURTS.....Galveston
MIRAMAR COURT.....Galveston
HOTEL CAVALIER.....Galveston
HOTEL PLAZA.....Laredo
HOTEL LUBBOCK.....Lubbock
HOTEL FALLS.....Marlin
HOTEL CACTUS.....San Angelo
HOTEL MENGER.....San Antonio
ANGELES COURTS.....San Antonio

VIRGINIA
HOTEL MOUNTAIN LAKE..Mountain Lake
HOTEL MONTICELLO.....Norfolk

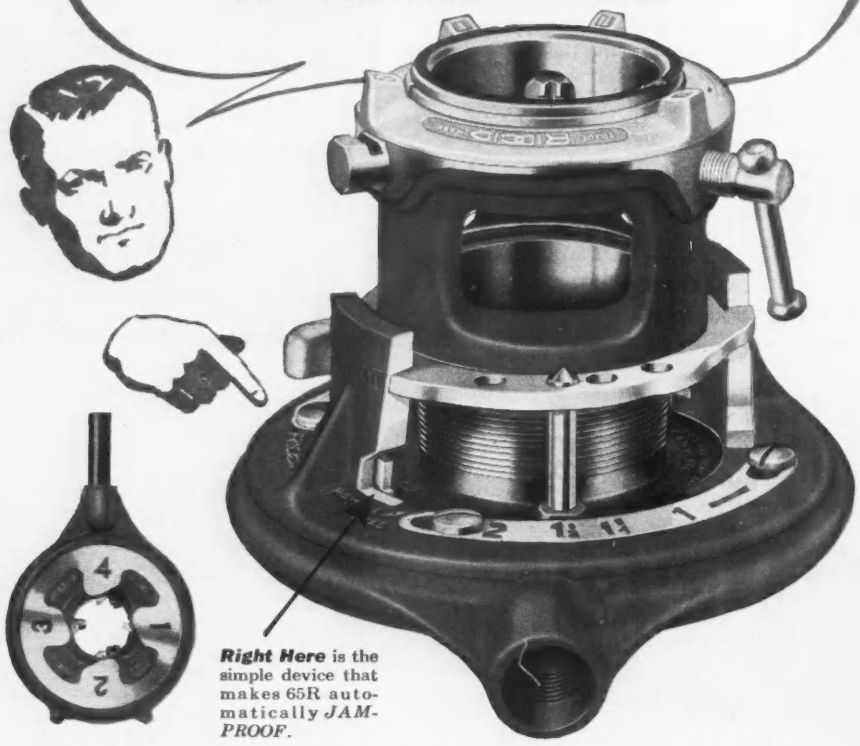


WASHINGTON
Washington, D. C.

BAKER
Dallas, Tex.

You can't jam the new RIDGID 65R

Really streamlined pipe threading with this RIDGID self-contained die stock



Right Here is the simple device that makes 65R automatically *JAM-PROOF*.

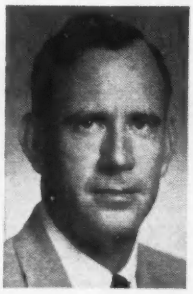
● You don't have to watch it—lead screw can't jam on workholder. New jam-proof drive plate automatically kicks out driving ratchet pawl when standard length thread is cut. Your recent model 65R easily converted—just buy new drive plate, put in place of old plate. Perfect threads on 1" to 2" pipe with one set of 4 high-speed steel dies—sets to pipe size in 10 seconds, mistake-proof self-centering workholder sets instantly! Buy the new jam-proof RIDGID 65R at your Supply House.

RIDGID

★ Work-Saver Pipe Tools ★

THE RIDGE TOOL CO. • ELYRIA, OHIO

EQUIPMENT and SERVICE SUPPLIERS' NOTES



J. L. Tullis

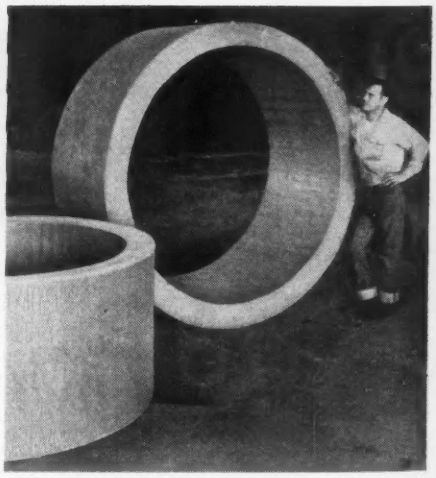
E. S. McRoberts

Beaird's General Sales Manager Is Named to National Advisory Groups

J. L. Tullis, general sales manager for The J. B. Beaird Company, Shreveport, has been appointed to national industrial advisory committees for two federal agencies.

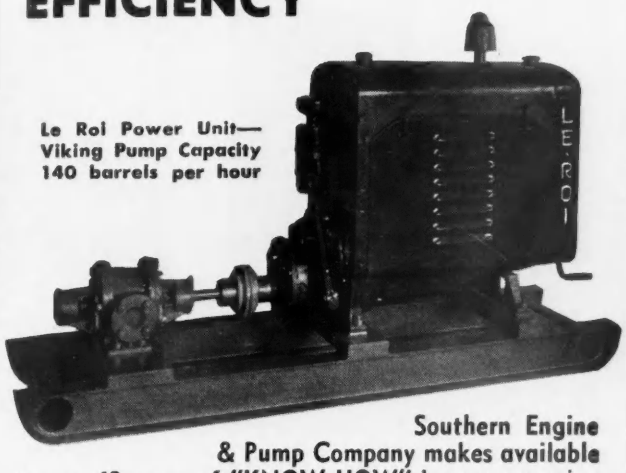
He is one of 15 men chosen by the National Production Authority to serve as an advisory committee on matters affecting industries which fabricate steel plate. He has also been named by the Office of Price Stabilization to a similar committee representing manufacturers of fabricated standard line pressure and non-pressure tank equipment.

The Beaird Company also announced that E. S. McRoberts, formerly assistant chief engineer, has been appointed manager of compressor sales. For the past six years, McRoberts has been active in design and development of the Beaird packaged compressor plant. He has been with the company since 1944, previously having been with the Engineering and Construction division of Frick-Reed Supply of Tulsa.



Giant Gear Forgings, now in use on speed increaser units at pumping stations along the 1000-mile Mid-Valley pipe line from four south central states to Ohio, were forged, heat-treated and rough-machined at The National Supply Company's plant at Torrance, Calif. The rings are of SAE 4340 forged alloy steel, 83 inches o.d. x 76 inches i.d. x 21 inches face, the rough weight of each being 15,255 pounds. They are the outer rims of the bull gear for each of the eight 1700 horsepower speed increaser units along the pipe line. Pacific-Western Gear Company completed manufacture of the gears.

THE RIGHT TEAM FOR EFFICIENCY



Le Roi Power Unit—
Viking Pump Capacity
140 barrels per hour

Southern Engine & Pump Company makes available to you 40 years of "KNOW HOW" in your pumping requirements.

• Complete units and replacement parts at all branches.

SOUTHERN ENGINE & PUMP COMPANY

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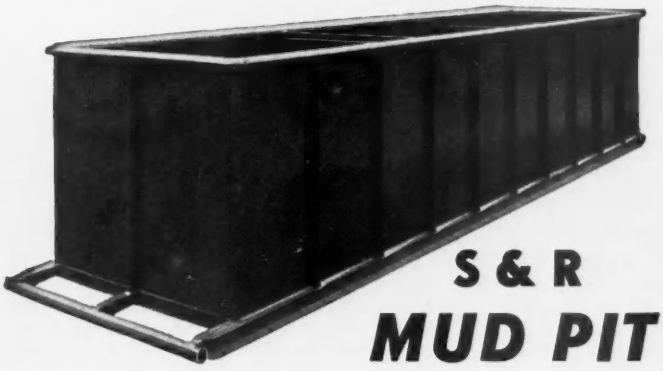


S & R MUD PIT

S & R Mud Pits are practically indestructible . . . with any reasonable care in loading and transporting, they will give years of service.

Standard pits are 6 feet deep, 30 feet long, 7' 6" wide and have a capacity of 234 barrels. Bottoms are ¼" steel plate; sides of 3/16" or ¼" as specified. Heavy reinforcing . . . 3" channel iron ribs on 36" centers . . . provides utmost strength and rigidity along the sides. Top cross braces are above the mud level in the tank, so that the interior is absolutely free of obstructions. A clean-out plate is furnished at one end.

S & R Steel Mud Pits are skidded on 6" H-Beams, with heavy cross-braces along the length. Skids are 8 feet wide and 33 feet long; the pits may be hauled on any standard oil field trailer. Beams are recessed at each end, so that the winch line may be snubbed or wrapped around the ends of the braces for speed, safety and convenience in loading and unloading.

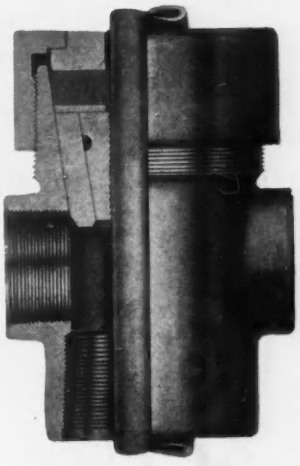
Write for further information.

S & R TOOL & SUPPLY CO.
P. O. Box 1755 155 McCarty
HOUSTON 1, TEXAS
Export: 233 Broadway, New York 7, N. Y.

S & R TOOL AND SUPPLY CO. HOUSTON, TEXAS

FOR STRENGTH WHERE IT'S NEEDED MOST USE STEEL FORGINGS BY BEAUMONT WELL WORKS

Beaumont Well Works is equipped with the tools and the know-how to strengthen your product and reduce your manufacturing costs with forgings. Carbon, alloy, and stainless steel forgings made to your specifications will help reduce your costs of manufacture and will put more sales appeal in your product. Now, without investing a cent in forge equipment, you can compete successfully with the largest manufacturers of oil field equipment. Investigate the advantages of steel forgings, then call on Beaumont Well Works for specific engineering and manufacturing information concerning your product.



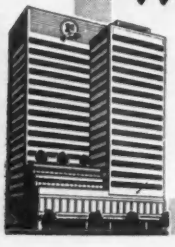
An example of the strength and safety built into a product by Beaumont Well Works Forgings.

BEAUMONT WELL WORKS COMPANY
INCORPORATED
BEAUMONT, TEXAS

No doubt You have heard the expression
that Tulsa is the "Oil Capital of the world"
A sentiment to which we heartily subscribe
but in some other Southwestern cities
they hear it and their
hair gets curled....

However, it's a point we don't need to debate
Because we want to relate
That Tulsa - and the FIRST of TULSA
foster lots of industries besides
those related to Black Cold.....

Many, Many, Many more than this paid
advertisement would hold.....
So, while we're best known for our
Successful toil in oil and
businesses related thereto
Our Bank Services include work on all kinds
of Industries, and all the help you'd care to
Have in this area. So if You are interested in
Tulsa industries and for Spavinaw water
water have thirst
Let's talk it over-come in-Think...FIRST!



THINK 1st of Tulsa

★ In our Correspondent Bank Department, You should know, Elmo Thompson, Joe Byrd, Harry Lane, Bill McLean, and Dick Wagner.

THE FIRST NATIONAL BANK AND TRUST COMPANY OF TULSA

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

EQUIPMENT and SERVICE SUPPLIERS' NOTES

John B. Merritt

Robert T. Harcus

Byron Jackson Company Assigns Three Key Executives to Division Posts

Three top management changes have been announced by Byron Jackson Company. Robert T. Harcus, executive vice president and general manager of International Cementers, Inc., has been named assistant to the president. He is replaced as ICI general manager by John B. Merritt, formerly general manager of Patterson-Ballagh Division. Merritt's previous post is now filled by James T. Workman, who has been assistant to the president.

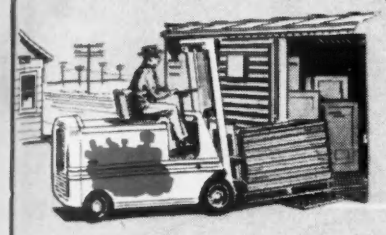
James T. Workman

Harcus was graduated from the University of Edinburgh, Scotland, in 1922 with a B.Sc. degree in mining, specializing in petroleum. He joined Burmah Oil Company and spent 23 years in India and Burma as fields superintendent and then as prospecting fields manager. During these years, he made several trips to the U. S., and thus became acquainted with Byron Jackson Company. In 1945 he joined the company as export representative, and made several trips to the United Kingdom and Argentina. In 1947, he undertook development of the jet process of perforating for BJ, and remained in this capacity until 1949, when he went to International Cementers, Inc., as executive vice president and general manager.

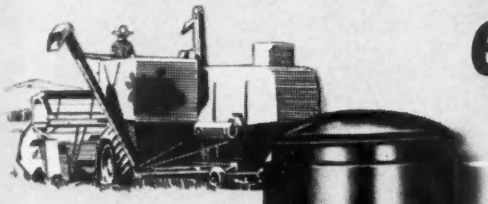
Merritt, a 1939 graduate of the University of California, joined BJ's Production department in 1940. He became production manager of the Munitions Plant during the war, and continued there until 1947, when he became assistant to J. C. Ballagh, vice president and general manager of Patterson-Ballagh. He became general manager at the time of Ballagh's retirement in 1949.

Workman entered the Army Air Force soon after his graduation from the University of California in 1931. During the war, he was attached to the Air Materiel Command of the Air Force and was concerned with production problems of companies making products for the Air Force. He joined BJ in 1946 as assistant to the vice president in charge of production and in 1948 was named assistant to the president.

FIGHTING HEART



...of all this equipment!



Chrysler Industrial 15 — one of eight basic models.

CHRYSLER-BUILT INDUSTRIAL ENGINES ARE THE SOURCE OF POWER FOR:

- *Ditching Machines*
- *Cranes*
- *Truck Mixers*
- *Shovels*
- *Loaders*
- *Yarders*
- *Concrete Mixers*
- *Road Pavers*
- *Crane Carriers*
- *Scoop Tractors*
- *Air Compressors*
- *Hoists*
- *Derricks*
- *Pumps*
- *Generators*
- *Conveyors*
- *Tackle Blocks*
- *Winches*
- *Tractors*
- *Combines*
- *Gang Mowers*
- *Spreaders*
- *Irrigation Equipment*
- *Orchard Sprayers*
- *Hay Choppers*
- *Pumps*
- *Feed Mills*
- *Sprinklers*
- *Locomotives*
- *Motor Coaches*
- *Drilling Equipment*
- *Air Conditioning Equipment*
- *Pulp Machines*
- *Fire Pumps*
- *Street Flushers*
- *Snow Plows*
- *Oil Well Pumps and Drillers*

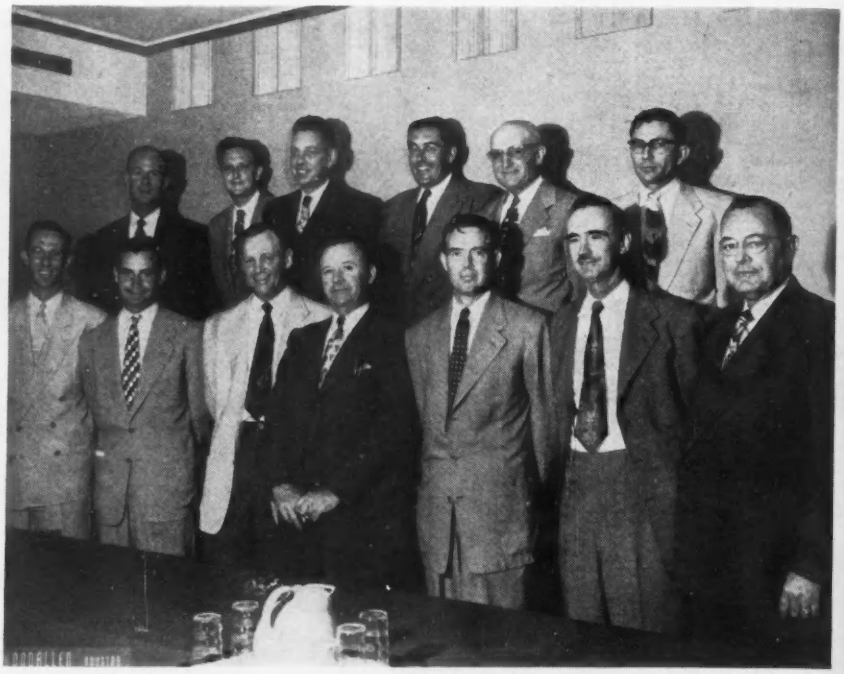
Original equipment manufacturers the nation over install Chrysler Industrial Engines in their equipment because Chrysler-built means better performance . . . rugged dependability . . . trouble-free operation . . . longer operating life, service everywhere.

Continuous Chrysler research in higher alloy steels and famed Chrysler engineering have produced an industrial engine capable of sustained high speeds with less wear . . . an engine that costs less to operate, less to maintain.

A letter of inquiry will bring you a qualified Chrysler engineer. Address: **Industrial Engine Division, Chrysler Corporation, Detroit 31, Michigan.**

CHRYSLER
Industrial Engines

HORSEPOWER WITH A PEDIGREE



Unibolt Representatives pictured at Thornhill Craver Company's annual sales meeting in Houston are, left to right, back row, Frank Baker, W. J. Hill, F. L. Helton, Clint R. Horn, Walter A. Hammann, J. C. Hembree. Front row, M. E. Moore, T. J. Billings, H. E. Thornhill, Earl Grissom, Bert Griffin, J. E. Loeffler and Kenneth Craver.

STEEL Kelley PRODUCTS

Do You Need a Good New Source of Metal Stampings for Defense Contracts?

Kelley has the facilities, the know-how, and the men to do your job and to do it right. From start to finish Kelley is your one source—to help you engineer stampings, to design and make the tools, and, most important, to deliver the job to your specifications on time. Kelley cut its teeth in oilfield equipment, uses that experience to make your job better.

Write for this booklet, a complete description of Kelley, shows work done, lists machines, shows how Kelley will help you.

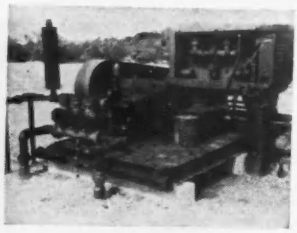
Kelley
MANUFACTURING CO.
4800 Clinton Drive P. O. Box 17
Houston, Texas

SECONDARY MODERN RECOVERY
TECHNICAL CONSULTING
PRODUCTION ENGINEERING
SERVICE, INCLUDING
CORE ANALYSIS

PRESSURE MAINTENANCE WITH GAS OR WATER

REPRESSURING WITH GAS OR WATER

Water Disposal Triplex Pump and Engine Unit Installation



Jones County, Texas

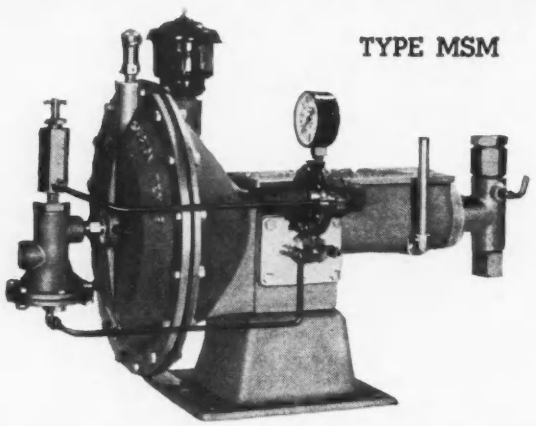
SURVEYS
ESTIMATES
DESIGN
INSTALLATION
SUPERVISION

PETROLEUM ENGINEERS
CABLE & STAPLES
WICHITA FALLS, TEXAS

TEXSTEAM

for the finest in chemical pumps

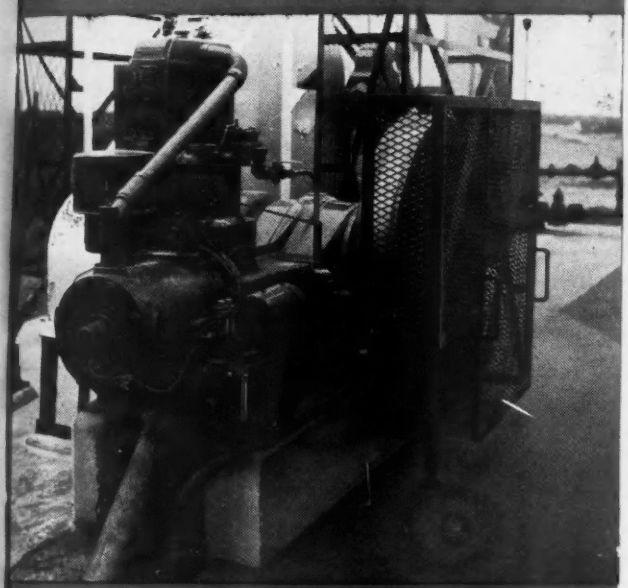
TYPE MSM



Injection pressures up to 20,000 psi, with volumes from ½ pint to 360 gallons per 24 hours! Here's the **finest** pump for handling chromates and other corrosion inhibitors under continuous, high pressure operation.

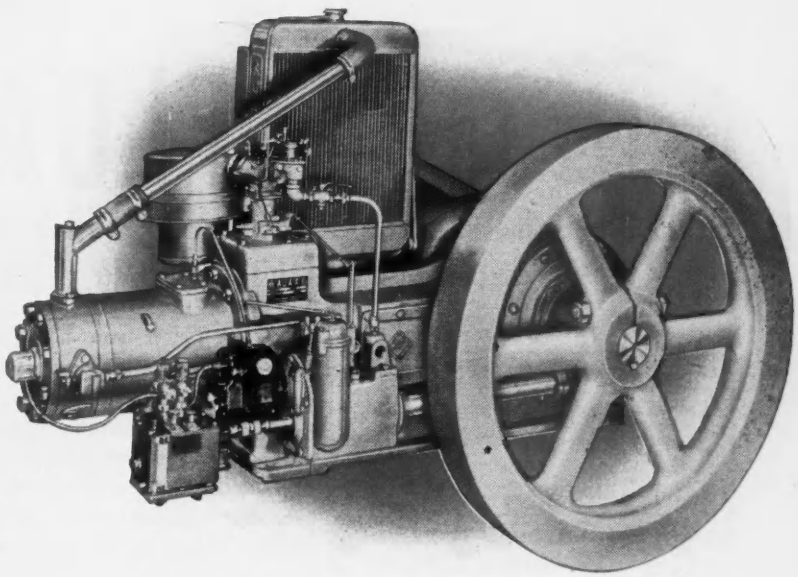
BETTIS CORPORATION

P. O. BOX 9091 HOUSTON 11, TEXAS



CHOSEN BEST

by *Comparative Test!*



Ajax

GAS and OIL ENGINES

Every month, more of the steady stream of AJAX Engines rolling to every field are *ordered on the basis of exacting comparative performance analyses.*

In every instance that has come to our attention, where careful checks have been made on operating economy, maintenance costs, ease of servicing and all-around dependability—*AJAX leads.* Such tests confirm the practical experience of Ajax users everywhere. Talk it over with your Supply Man!

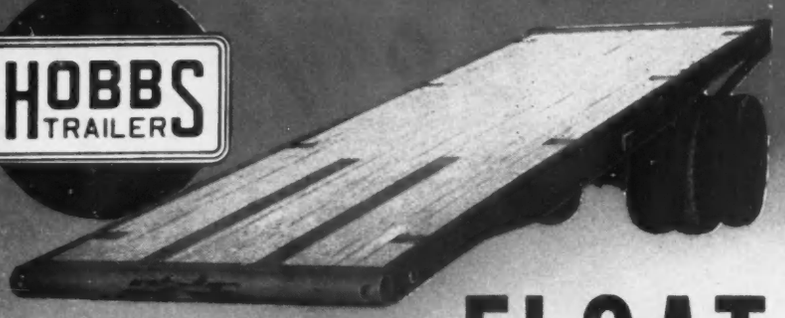
AJAX IRON WORKS
CORRY, PENNSYLVANIA

Oil Field Distributors: THE NATIONAL SUPPLY CO., TOLEDO, OHIO
R. B. MOORE SUPPLY CO., INC., BOLIVAR, N. Y. · BETHLEHEM SUPPLY CO., TULSA, OKLA.

Load 'Em and Move 'Em

With One Man, a Winch and a

HOBBS TRAILER



SELF-LOADING FLOAT

Tandems Rated at 50,000--75,000--100,000 lbs.
Single Axle Model with 30,000 lb. Rating

Load drawn on float by winch line after float has been lowered to ramp position and tractor backed against rear end of float.

After load is in place, tractor is returned to front and float is raised to hauling position by means of winch.

Loaded and ready to go. Entire job done by one man, Hobbs Self-Loading Float, and winch-equipped tractor.

When you have something heavy to move you can always call on your Hobbs Self-Loading Floats. Developed and engineered in the oil fields, this equipment is ideal for moving rigs, draw-works, butane tanks, other heavy and massive units, bulldozers, road building equipment. Hobbs Self-Loading Floats are famous for saving time and labor — for their super strength, easy loading, long service. Write, wire, telephone or cable HOBBS MFG. CO., FORT WORTH, TEXAS, for complete details. (Please mention this publication).

HOBBS MANUFACTURING COMPANY

FACTORY SALES AND SERVICE — Fort Worth, Houston, San Antonio, Lubbock, Texas. DISTRIBUTOR SALES AND SERVICE — Hobbs Trailer Equipment Co., Dallas, Texas; Hobbs Trailer Sales Co., El Paso, Texas; H & H Equipment Co., Okla. City, Okla.; Hobbs Trailer Co., Wichita, Kansas.

HOBBS TRAILER

OIL FIELD and COMBINATION Bodies

The "Utility Men" of the Oil Fields

Sturdy all-steel bodies decked with oak or steel plate, equipped with drill-pipe gin poles and extra heavy, rolling tail pipe. Oil Field Body has king pin for engaging inverted fifth wheel mounted on trailing equipment; Combination Body has new cable-released fifth wheel to engage standard king pins.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

G. G. Gibbs

J. G. Henderson

Technical Oil Tool Firm Appoints Two Engineers in Mid-Continent

Technical Oil Tool Corporation, Ltd., has appointed Jack G. Henderson to its Odessa, Texas, staff. He will work under the direction of F. E. Sievers.

Also in the Mid-Continent area, G. G. (Bud) Gibbs has been assigned to the North Texas area, covering Wichita Falls, Nocona, and Graham, Texas. He assists R. K. Palmer.

Worthington-Gamon Meter Is Made Worthington Corporation Division

Worthington-Gamon Meter Company, Newark, N. J.—formerly a subsidiary of Worthington Pump and Machinery Corporation — has been made a division of that corporation. The new division will continue the manufacture of liquid meters at the former company's Newark plant, according to H. C. Ramsey, president of Worthington Pump and Machinery Corporation, Harrison, N. J.

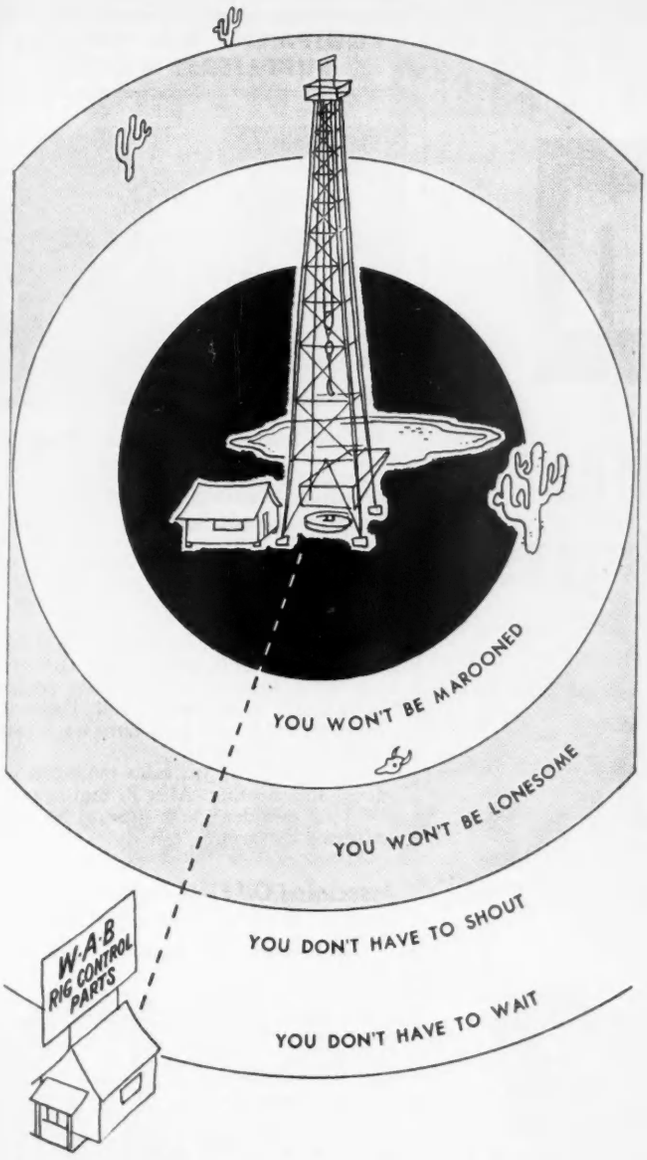
R. R. Anderson

Robert R. Anderson, formerly president, Worthington-Gamon Meter Company, has been elected vice president of Worthington Pump and Machinery Corporation and will act as general manager of the new division.

William C. Flanders, formerly vice president of the meter company, has been appointed assistant general manager of the division and Walter H. Zeis, formerly secretary and treasurer of the meter company, has been elected assistant secretary of the Worthington corporation. Anderson joined the meter company in 1922. In 1932 he was elected treasurer; 1942 vice president; and last year president of the Worthington-Gamon Meter Company

Flanders joined Gamon Meter Company in 1925 as sales representative in New Jersey and was appointed sales manager in 1937 and vice president in 1950.

Zeis started his career with the Worthington corporation in 1925 and served in various accounting capacities until his election as treasurer of the Worthington-Gamon Meter Company in 1948. He was also elected secretary of the subsidiary company last year.



We Aim to Stick Close to YOUR job

When you own a rig with W.A.B. Controls, you not only get tops in performance and dependability—but assurance of speedy maintenance service, too. Our Parts Stocks are spotted at convenient points . . . so you're never far from a source of supply, organized to serve you fast and well. Make a note of the address in your locality, so you can reach us at once in case of need.

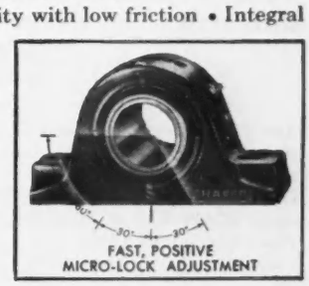
WESTINGHOUSE
AIR BRAKE COMPANY
WILMERDING, PENNA.
INDUSTRIAL PRODUCTS DIVISION

Factory Branch: Emeryville, Calif. Distributors throughout the United States. Consult your Classified Directory. Distributed in Canada by: Canadian Westinghouse Co., Ltd., Hamilton, Ontario

BIG LOAD CAPACITY PACKED IN SMALL SPACE

Shafer ConCaVex Bearings have the design and construction features that keep them free-rolling, self-aligning and self-centering under *all* operating conditions at *all* times—without additional weight or size, without shoulders, without auxiliary means of absorbing thrust.

With Shafers you get stamina and performance advantages exceeded by none: Capacity for radial, thrust or any combined radial-thrust loads • High shock load capacity with low friction • Integral self-alignment within the bearing itself • Exclusive Micro-Lock for quick, simple bearing adjustment • Exclusive, self-centering "Z" Type Housing Seal • Compact sturdiness combined with the original Shafer ConCaVex design which has answered industry's every dependability need for more than 32 years. Complete engineering service for the asking. SHAFER BEARING CORPORATION, 801 Burlington Ave., Downers Grove, Ill.



Ask for new Industrial Bearing Catalog No. 51.

SHAFER CONCAVEX

Pillow Blocks • Flange Units • Cartridge Units • Flange Cartridge Units • Duplex Units • Take-Up Units • Take-Up and Frame Units • Unmounted Bearings • Aircraft Control Bearings.

best anywhere

McGOWAN

self-priming centrifugal pumps for oil field jobs

Here is the outstanding pump in its field. It is designed, engineered and constructed with McGOWAN "know-how". Now in operation in oil fields all over the world. All welded steel design for greater strength and lighter weight.

Features include automatic priming, non-clogging impeller, hardened wear plates, large access plates, tested and trouble-free shaft seals.

See your Supply Co. or call direct. FREE CATALOG on request to: Dept. A, McGowan Pump Division, Leyman Mfg. Corp., Central Ave., Cincinnati, Ohio.

SINCE 1852 McGOWAN PUMPS

McGOWAN PUMP CO.
CINCINNATI, OHIO

division of
LEYMAN MANUFACTURING CORPORATION

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Alex P. Smith

Harry S. Zane, Jr.

Executives, Representatives Attend Guiberson Firm's Fall Sales Meeting

More than 35 sales representatives and executives of The Guiberson Corporation attended the firm's fall sales meeting in Dallas.

One of the meeting's events was a clinic on gas lift installations with the Guiberson Type "A" flow valve. Two new packers, Type "WF" water flood, and Type "H" hydraulic hold down anchor, were introduced and discussed.

Harry S. Zane, Jr., sales manager, conducted the meeting. Alex P. Smith, executive vice president and general manager, addressed the group.

Associated Oil Field Rentals Names Hopkins Assistant Manager of Yards

R. F. (Hop) Hopkins has joined Associated Oil Field Rentals, Inc. as assistant manager of the organization's main office and yard in Houston. He is also assistant manager of the branch yards at Alice and Odessa, Texas, New Iberia and Harvey, La., and Oklahoma City. Hopkins was formerly with American Iron and Machine Works, Oklahoma City.

R. F. Hopkins

Mechanical Engineer Joins Ideco as General Manager of Torrance Plant

J. J. Rosecky has been appointed general manager of the Torrance, Calif., plant of the Ideco division of Dresser Equipment Company. Rosecky was previously vice president of manufacturing for Heil Company, Wilwaukee.

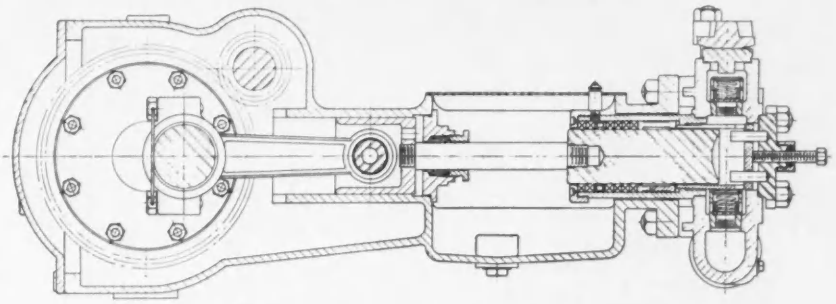
J. J. Rosecky

Rosecky is a mechanical engineering graduate of the University of Wisconsin. Upon graduation he trained at Allis-Chalmers Manufacturing Company and subsequently became an engineer in the Steam Turbine department. In 1931 he joined A. O. Smith Corporation as plant engineer, and in 1938 he returned to Allis-Chalmers as general works manager of Heavy Machinery plants.

DEPENDABILITY-ECONOMY-SERVICE

This new pump has been perfected through the field experiences of oil field engineers, Harley Sales Company and The Deming Company, who have been manufacturing pumps for 71 years.

- The fluid end is made of acid resisting bronze, and is stainless steel fitted.
- The new valves are flat and spring actuated, and the power end is sealed with conventional packing with an adjustable gland.
- Pumps are applicable for pumping sweet or sour crude oil, salt water disposal, pilot flood units and as sump pumps at pipe line stations.



TRIPLEX PUMPS–Sizes 30 to 50 BPH at 1000 lbs.

MOST H. P. HOURS WISCONSIN HEAVY-DUTY Air-Cooled ENGINES

This is only one of the many units which Harley Sales Company has helped to develop for the diversified problems arising each day in the oil industry. All of these custom-built units are powered by WISCONSIN air-cooled Heavy Duty Engines in the range of 2 to 30 H.P.

Service and Parts for Wisconsin Engines Are Available in All Oil Fields

HARLEY SALES COMPANY

HOUSTON TULSA WICHITA

. . . another reason why drillers prefer

Standco NO-SMOKE BRAKE LINING

Standco Brake Blocks are made of cabled cords of long fibre asbestos — woven solid and reinforced with bronze wire to prevent pulling loose on the bolts. They will not burn or smoke or score brake rims.

More deep wells have been drilled with Standco than with all other blocks combined. It's your answer for low-cost hole-making.

STANDCO BRAKE LINING COMPANY

Factory and General Offices

2701-2801 Clinton Drive Houston, Texas

"Mud-O-Graf"

CONSTANT MUD CONTROL BLOWOUT PROTECTION

The Mud-O-Graf eliminates the usual trial and error method of adding weighting material or water to maintain the correct specific gravity.

The condition of mud in the hole is recorded automatcially during every minute of drilling operations. With this information constantly before the driller, he can maintain a uniform mud weight. He can instantly detect weight variations of less than 1/10-pound per gallon, the presence of gassy streaks, their volume and frequency of occurrence. Possibility of blowouts, caused by gas or salt water incursions ordinarily not detected until strong enough to cause the well to kick, is minimized.

Write today for further information showing how the Mud-O-Graf will benefit you.

Check these advantages:

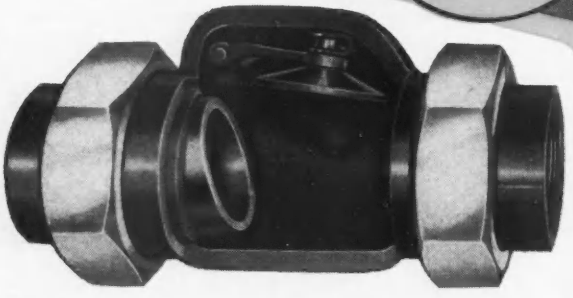
- Provides accurate information for uniform mud control.
- Helps prevent blowouts by showing the duration and relative amount of gas in gassy streaks.
- Increases accuracy in the use of weighting materials, chemicals, and water.
- Indicates graphically all heavy and light streaks in the circulating system.

WARREN AUTOMATIC TOOL CO. WATCO HOUSTON

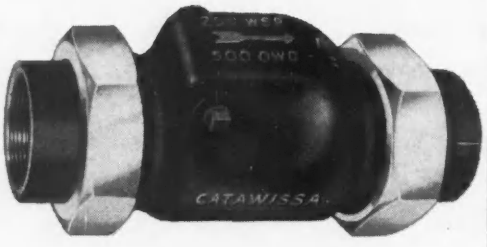
WARREN
AUTOMATIC TOOL CO.
1920 HUSSION ST. HOUSTON, TEXAS
LAFAYETTE, LA ODESSA, TEXAS

FLOW LINE AND PIPE LINE TYPE

FULL OPENING FOR 100% UNOBSTRUCTED FLOW!



Here is a FULL OPENING Double Union Swing Check Valve designed and recommended for the rough and ready demands of oil country applications. A compact, efficient, economical, easily accessible unit for use in lines where no stop is installed close to the check valve and where pipe cleaning mechanisms are used. Equipped with Catawissa PERFECT SEAL Unions on both ends!



SIZES: 2" to 4"; Refax Metal bodies, Hitensiloy working parts; 500-lbs. service OWG; 1500-lbs. test; 250 psi WSP

write for CATALOG 11 showing the complete Catawissa line

CATAWISSA PERFECT SEAL UNIONS AND VALVES ARE STOCKED & DISTRIBUTED BY

OIL WELL SUPPLY CO.
Branches Serving All Oil Fields

CATAWISSA VALVE & FITTINGS COMPANY
60 MILL STREET ★ CATAWISSA, PENNA.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Mid-Continent Assigns Personnel, Establishes Branch in Colorado

John H. Kenyon, former sales engineer at Wichita Falls, Texas, for Mid-Continent Supply Company, has been transferred to the Fort Worth Machinery department as sales engineer. Also at the Fort Worth general office, Dan D. Rogers has been appointed traffic manager.

John H. Kenyon

Kenyon joined Mid-Continent in April, 1947, in the Machinery department. In June that year he was transferred to Shreveport, and later to Wichita Falls. He holds a B.S. degree in civil engineering from V.M.I., and took graduate work at M.I.T.

Rogers has had 26 years in the traffic field, and before joining Mid-Continent was chief traffic clerk for Missouri-Pacific Railroad Company.

The second Mid-Continent store in the Rocky Mountain area has been opened at 1200 Main Street, Sterling, Colo. S. A. Worrall has been named manager of the Sterling store and H. T. Branum and J. D. Bell are field salesmen. Worrall, formerly a field salesman in the West Texas-New Mexico division, was field representative at Sterling before the new store was opened. Branum was transferred from Eunice, N. M., and Bell was formerly at Casper, Wyo. Other Sterling personnel are W. E. Phillips, W. L. Ross and H. D. Weaver, storemen.

U. S. Steel Corporation Elects Vice President–Raw Materials

Robert M. Lloyd has been elected vice president—Raw Materials of United States Steel Company, M. W. Reed, executive vice president—Engineering and Raw Materials, announced.

After graduating from the University of Pittsburgh with a B.S. Degree in Electrical Engineering, Lloyd completed several years work in metallurgy at Carnegie Institute of Technology. He first joined U. S. Steel as an employe in the Sales department of the Carnegie-Illinois Steel Corporation in 1926.

Lloyd was transferred to the Raw Materials Department of Carnegie-Illinois in 1933 and after several promotions he was made assistant director of raw materials for the company. He was appointed assistant to vice president of the former United States Steel Corporation of Delaware in December, 1945, and became assistant vice president of United States Steel Company on January 1, 1951.

Union Wire Rope Names Agent

Union Wire Rope Corporation has appointed Gregg Stock representative at the Houston branch, working in the southern part of Texas. He is a graduate of Kansas University, and after spending three years in the Navy entered the Sales Training School of Union Wire Rope.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

New Chiksan Sales Representative Is Assigned to Eastern Headquarters

C. E. (Neil) Thomas has joined the sales staff of Chiksan Company, Brea, Calif., and has been assigned to Chiksan's eastern headquarters, 155 Washington St., Newark, N. J. Thomas was previously a sales representative for General Cable Corporation, covering the New York metropolitan area and New Jersey.

C. E. Thomas

Chiksan also announced the appointment of Hydrobel, S.A., Liege, Belgium, as export sales representative for Belgium, Grand Duchy of Luxembourg, and the Belgian Congo. Hydrobel will handle sales of Chiksan industrial and hydraulic swivel joints and WECO unions.

Nordstrom Valve Division Appoints Altorfer to Top Engineering Post

Hans A. Altorfer has been appointed chief engineer, Nordstrom Valve Division of Rockwell Manufacturing Company, Oakland, Calif.

A graduate of the Winterthur Institute of Technology in Switzerland, Altorfer has 20 years experience in mechanical engineering, theory and design practice. Before joining Nordstrom, he was supervisor of the Turbo-Power Development department of Allis-Chalmers Manufacturing Company, engaged in the design and development of steam and gas turbines.

Probst to Coordinate Western Area Sales for Clark Bros. Company, Inc.

Clark Bros. Company, Inc., has appointed George W. Probst western regional sales manager, to coordinate sales of the California, Oklahoma, Texas and Chicago territories. His headquarters will remain in the Clark Bros. sales office at 125 West First Street, Tulsa.

George W. Probst

Probst has been in Clark's Sales department for the past 30 years. He has previously been district sales manager of the Tulsa district.

Detroit Diesel Division Announces $1 Million Building Expansion Plan

Detroit Diesel Engine Division, General Motors Corporation, announced plans for a $1 million building expansion program to increase production facilities. This is the eighth major expansion the division has made, and will add almost 80,000 square feet to the 1 million square feet now under cover. Since 1938, the division has produced more than 50 million horsepower in two-cycle diesel engines.

Nobody *"talks oil"* like an *Oil Man*

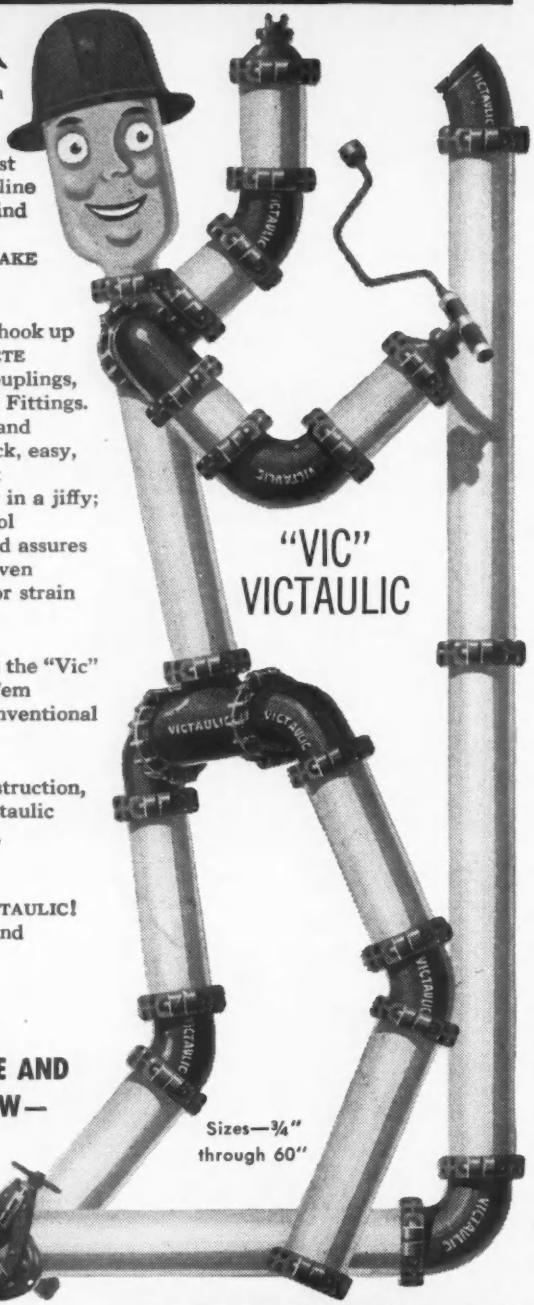
That's why the First National's Oil and Gas Department is staffed with technical and practical oil men. They are familiar with every phase of exploration, drilling, production and plant operation. You are invited to visit the bank, get acquainted with these officers and learn about First National's facilities for handling your financial requirements. Or, if more convenient, a member of the Oil and Gas Department staff will be pleased to call on you.

FIRST NATIONAL BANK

BUILT ON SERVICE 1st SINCE 1866 *in Houston*

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

WORLD'S BEST METHOD FOR PIPING



The Victaulic name stands for pioneering and world leadership in quick, dependable piping construction. Victaulic offers a *complete method* of piping that just can't be beat! From one end of the line to the other... for almost every kind of piping job... you'll find that Victaulic's the EASIEST WAY TO MAKE ENDS MEET!

Victaulic is *not* just a quick way to hook up pipe line sections... it's a COMPLETE METHOD with a versatile line of Couplings, Full-Flow Elbows, Tees, and other Fittings. Victaulic offers wide adaptability and makes joining those pipe ends quick, easy, and economical. A simple two-bolt coupling brings pipe ends together in a jiffy; a speed or T-wrench is the only tool required. AND the Victaulic Method assures positive-locked, leak-proof joints even under extreme pressure, vacuum, or strain conditions.

Preparing pipe ends is a cinch with the "Vic" Method..."Vic-Groover" grooves 'em automatically, twice as fast as a conventional pipe threader!

On *your* next piping job — new construction, repairs, or alterations — try the Victaulic Method and you'll save time, work, and money!

Make that next piping job ALL VICTAULIC! Write today for Victaulic Catalog and Engineering Manual No. 44-8I.

NOTE VIC'S NEW COMBINED MAIN OFFICE AND PLANT ADDRESS BELOW—

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Mailing Address: Box 509, Elizabeth, N. J.
Phone: Elizabeth 4-2141
Victaulic Inc., 727 W. 7th St., Los Angeles 14, Calif.
Victaulic Company of Canada, Ltd., 406 Hopewell Ave., Toronto10
For Export outside U.S. & Canada: PIPECO Couplings & Fittings, Pipe Couplings, Inc., 30 Rockefeller Plaza, New York 20, N.Y.
27TH VICTAULIC YEAR

The easiest way to make ends meet
VICTAULIC
PIPE COUPLINGS AND FITTINGS

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EQUIPMENT and SERVICE SUPPLIERS' NOTES

Stewart & Stevenson Services Names Assistant Parts Department Manager

Charles W. Potthoff has joined Stewart & Stevenson Services, Inc. of Houston as assistant manager of the parts department, Joe Manning, general manager, announced.

C. W. Potthoff

Before joining the Stewart & Stevenson staff Potthoff was with the Parts Association in Cleveland, Ohio. Previous to that he was in the parts department of Dow Motor Company in Houston for 19 years. Potthoff has attended the General Motors parts school specializing in parts merchandizing.

Standard Seismograph Company Names Kezeler Executive Vice President

J. L. Kezeler has been named executive vice president in charge of field operations of Standard Seismograph Company, Oklahoma City. Kezeler recently resigned as chief geophysical engineer with Century Geophysical Corporation to accept the new position.

Kezeler received his degree in electrical engineering from Texas A. & M. College in 1930. He has worked with several exploration and geophysical firms, including McCollum Exploration Company, Seismograph Service Corporation, Texas-Louisiana Exploration Company, Engineering Laboratories, Key Velocities, Inc., and Century Geophysical Corporation.

Chanda Will Represent A. O. Smith In New York International Division

Joseph W. Chanda has been named New York representative of A. O. Smith Corporation International division. He succeeds A. E. Cripps, resigned.

J. W. Chanda

For the past three years, Chanda has been on the sales staff at the International division's headquarters in Milwaukee. In his new capacity, he will have offices at 250 Park Avenue, and will handle the company's export sales activities in New York and Washington, D. C.

Blackwell Joins BrakeSol Service

C. C. (Blackie) Blackwell, former representative for Pacific Pumps, Inc., has been named service representative for BrakeSol, Inc., with headquarters in New Iberia, La. He will serve supply stores in Louisiana, West Mississippi, Northern Arkansas and East Texas.

Plastic Coating Elects Director

Forrest Lee Andrews of the law firm of Andrews, Kurth, Campbell & Bradley, Houston, has been elected a director of Plastic Coating Corporation, Houston.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Worthington's Wilson Goes to Coast; Other Executive Assignments Made

Charles Ebem Wilson, sales vice president of Worthington Pump and Mashinery Corporation, Harrison, N. J., has been appointed a West Coast consultant on sales problems, assisting offices in Los Angeles, San Francisco, Seattle and Salt Lake City. In 1946 Wilson, in addition to his other duties, was made president of Worthington-Gamon Meter Corporation, then a Worthington subsidiary. A 59-year veteran of Worthington, Wilson has retired from corporation duties, except in a consulting capacity.

Charles Ebem Wilson

H. V. Rasmussen has been appointed executive engineer at the Wellsville, N. Y., plant of Worthington. For a number of years Rasmussen was engaged in steam turbine engineering with both Westinghouse Electric Corporation and DeLaval Steam Turbine Company.

Manufacturing executives assigned to new posts include George P. Passmore, assistant to the vice president in charge of manufacturing at Harrison, who had been works manager of the Wellsville, N. Y., plant since 1941. A. M. Tullo, who is now works manager at Wellsville, was formerly assistant works manager at Harrison. John Burlick, former manager of the Methods and Standards Department, is now assistant to the Harrison works manager, in charge of industrial engineering. Max A. Heyman, manager of the Production department at Harrison since 1945, is now assistant to the works manager in charge of production control.

Three engineering executives have new positions. W. D. Sizer, since 1940 executive engineer for the Harrison plant, is now manager of Regional Engineering and Service department, with headquarters at Harrison. George F. Habach, new executive engineer at Harrison, was formerly chief engineer of the Centrifugal Engineering division. Everett Schmachtenberg, former assistant chief engineer of the Centrifugal Engineering division, has been advanced to chief engineer.

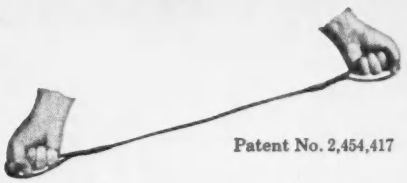
Porter Acquires Steel Firm

H. K. Porter Company, Inc., Pittsburgh, has acquired the Buffalo Steel Company, Tonawanda, N. Y., producer of light steel products. With the acquisition of this company and Connors Steel Company, Birmingham, last October, Porter has a total steel production capacity exceeding 200,000 tons.

Fluid Packed Pump Assigns Four

Additions to Fluid Packed Pump Company's sales force include Ray C. Green, formerly of British-American Oil Company, new Duncan, Okla., representative. Ray Housley has been transferred from Eldorado, Kansas, to Seminole, Okla., and Robert V. Holton is now stationed at Eldorado. David Russell, Jr., formerly of Oil Well Supply Company, is new district representative at El Dorado, Ark.

MAKE THIS TEST YOURSELF...WITH A FREE Tuffy® SLING



Patent No. 2,454,417

Tie a knot in a Tuffy Sling, then pull it tight with both hands and feet. See how flexible it is — and how it straightens out without damage. The secret is in the braided fabric construction — a patented Tuffy feature!

Scores of wires are stranded into 9 parts, then machine woven into an interlaced wire fabric entirely unlike conventional wire rope slings. Even cutting one of the 9 parts does not result in stranding. And eye splices develop up to 95% of the fabric strength.

11 Types of Tuffy Slings If none of the 11 factory packaged Tuffy Sling types exactly meet your needs, Union Wire Rope engineers will develop one that does. Tuffy Slings are proof-tested to twice safe working load. The safe working load is stamped on a metal band attached to each sling. If you have your own rigging loft, Tuffy braided fabric is available by the reel.

MAIL COUPON TODAY FOR YOUR FREE SLING
This special 3-foot sample is yours without cost so that you can prove to yourself the advantages of a Tuffy Sling. Just mail the coupon.

UNION WIRE ROPE CORP

More scrap means more steel turn yours in today!

UNION WIRE ROPE CORPORATION
Specialists in Wire Rope, Braided Wire Fabric and High Carbon Wire
2104 Manchester Ave. Kansas City, Mo.

Gentlemen: Please have my Union Wire Rope Fieldman deliver my free Tuffy sling sample.

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FIRM NAME _____

ADDRESS_____

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Published October 1951

WALTER E. SKINNER'S BRITISH

OIL & PETROLEUM YEAR BOOK

1951
42nd Annual Edition

Price

FOUR DOLLARS POST FREE

600 pages. In Demy 8vo, bound in RED cloth.

THE INTERNATIONAL STANDARD REFERENCE BOOK ON THE WORLD OIL INDUSTRY

762 COMPANIES

The book is invaluable to everybody interested in this important industry, its contents comprising complete up-to-date and reliable particulars concerning companies interested in all branches, Producers, Refiners, Transporters, Finance, and Oil Dealers.
Arranged in alphabetical order.

AMERICAN AND FOREIGN COMPANIES ARE FULLY DEALT WITH

Particulars given of each Company include the Directors and other officials; date of incorporation; seat of operations; nature of business, description of property, refining and other plant, crude oil production; details of capital; dividends paid; and the financial position as disclosed by the latest accounts. Highest and lowest prices of the shares for the last three years.

MANAGERS, ENGINEERS, AGENTS, etc. 492 names and addresses and the names of the companies in the book with which they are connected.

BUYERS' GUIDE—A list of Manufacturers of Oilfield and Refinery Equipment and Accessories comprising 705 headings, giving names, addresses and "who makes it" of English, American and Continental Oilfield Equipment companies.

ADVERTISEMENTS—248 of the world's leading oilfield equipment manufacturers and accessory companies advertise their products in the 1951 issue.

To secure a copy SEND FOUR DOLLARS to:

WALTER E. SKINNER

"OIL & PETROLEUM YEAR BOOK"

20, COPTHALL AVENUE, LONDON, E.C. 2, ENGLAND

EQUIPMENT and SERVICE SUPPLIERS' NOTES

Franks Manufacturing Names Pitezel As Oklahoma District Sales Manager

W. G. Pitezel

W. G. (Bill) Pitezel, sales coordinator of Franks Manufacturing Corporation, Tulsa, has been appointed Oklahoma district sales manager, according to Carl White, Jr., president. Pitezel has been with Franks for the past ten years, except for a three year period in the Army Air Force. He has worked in the shop as well as in practically every position in the Sales department.

Several Store Personnel Changes Announced by Continental Supply

Waif Strain, warehouseman and pump repairman at Lindsay, Okla., for The Continental Supply Company, has been transferred to Russell, Kansas, as store manager.

N. K. Keller, manager at Kermit, Texas, was transferred to Snyder, Texas, in the same capacity, and is replaced at Kermit by Conley H. Sims, formerly manager at Monahans, Texas. Sims is succeeded at Monahans by Roy A. Henley, who was advanced from floorman.

At Eunice, La., Tommy B. McClelland, assistant store manager, has been promoted to store manager.

J. I. McQuiddy, salesman at Kilgore, Texas, has been transferred to the Casper, Wyo., district office as manager of production equipment sales.

Louisiana Field Sales and Service Agent Named by Patterson-Ballagh

D. A. LaBauve

Denison A. LaBauve has been promoted to field sales and service man at New Iberia, La., by the Patterson-Ballagh Division, Byron Jackson Company. LaBauve has been with Byron Jackson since October, 1948, having his office in New Iberia, and handling Patterson-Ballagh products in that area. He served in the Merchant Marine during the war.

Distributor Opens Two Warehouses

Petroleum Distributing Company, Houston, distributor of oil field petroleum products and Jimmy Gray tool joint and drill collar compounds, has opened additional warehouses at Williston, N. D., and Lovington, N. M.

Grant Opens Compton Branch

Grant Oil Tool Company has opened a sales and service branch at Compton, Calif., under the management of Curt Linkey. The branch will serve the Los Angeles Basin area.

EQUIPMENT and SERVICE SUPPLIERS' NOTES

R. D. Atchley D. G. O'Brien

Former M.I.T. Researchers Assigned To Midwestern Geophysical Staff

Two instrument design and research engineers, formerly on the staff of the Dynamic Analysis and Control Laboratory at Massachusetts Institute of Technology, have joined Midwestern Geophysical Laboratory, Tulsa.

Raymond D. Atchley has been elected vice president in charge of engineering, and Donald G. O'Brien has been named chief engineer.

Rockwell Vice President Is Named Chief of NPA Valve-Fittings Branch

A. J. Kerr, vice president of meter and valve sales for Rockwell Manufacturing Company, has been appointed chief of the Valves and Fittings Branch, General Components Division, of the National Production Authority. He will work under the direction of Eugene S. McCarthy, director of the division, and will headquarter in Washington, D. C. Charles W. Burrage, whom he succeeds, is returning to The Lunkenheimer Company, Cincinnati.

A. J. Kerr

South American Firm to Represent Black, Sivalls & Bryson Products

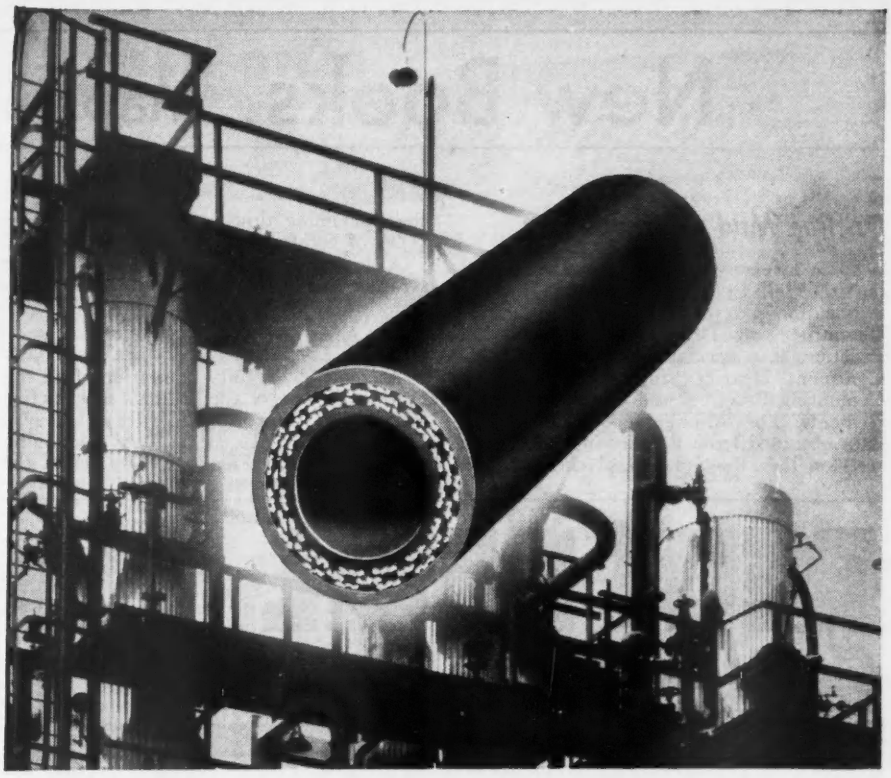
Black, Sivalls & Bryson, Inc., has signed a representative agreement with Oil Field Sales & Service, C.A., of Anaco, Venezuela, to represent its line of oil field equipment in Venezuela, Colombia and Trinidad.

Oil Field Sales & Service is headed by Allen Pike, president, and jointly owned by Paul Koester.

Pike, a graduate of Texas A. & M. College, was formerly with Gulf Oil Corporation as a reservoir and petroleum engineer. Koester, too, was formerly with Gulf.

Taylor Forge Adds Gale Carroll

Gale Carroll has joined Taylor Forge & Pipe Works and has been assigned to the Houston district sales office. Carroll was formerly sales and advertising manager for Tube-Kote, Inc. He is a member of Nomads, NACE and API. He attended Hastings College and the University of Nebraska.



Turn on the Steam . . .
THIS HOSE CAN TAKE IT!

When you work with steam, high heat and high pressure play havoc with conventional steam hose. It takes a hose *built for the job* to carry saturated steam at temperatures up to 388° and pressures up to 200 lbs. . . . and do it day in and day out without failure!

Hewitt-Robins Monarch® Fiberglas* Steam Hose does just that, under the toughest kind of heavy duty service.

Here's why:

THE TUBE is an exclusive Hewitt-Robins development — a special, heat resisting rubber compound that *stays* soft and flexible without flaking or cracking.

THE CARCASS is made of multiple braids of famous Fiberglas cord—*unsurpassed for heat resistance and strength*—and heavily insulated with heat-resistant rubber. Fiberglas makes this hose kink- and rupture-proof, extremely light, flexible and easy to handle.

THE COVER is extra-tough, extra-thick, won't strip or blister . . . highly resistant to heat, abrasion and weather.

For fire fighting and general steam service in the oil industry, *there's no better hose made.*

Call your Hewitt Rubber Distributor, (listed under "Rubber Products" in the classified 'phone book) or write Hewitt Rubber Division, 240 Kensington Avenue, Buffalo 5, New York.

HEWITT-ROBINS
FIBERGLAS STEAM HOSE

*T.M. of Owens-Corning Fiberglas Corp.

HEWITT-ROBINS HR **INCORPORATED**

AIR HOSE • BARGE LOADING HOSE • FIRE HOSE • FLOATING ROOF TANK DRAINAGE HOSE
FLUE CLEANING HOSE • FUEL OIL & GASOLINE HOSE • OIL SUCTION & DISCHARGE HOSE
STEAM HOSE • TRUCK TRANSPORT & TANK CAR DISCHARGE-SUCTION HOSE • TANK TRUCK HOSE
WATER HOSE • PROPANE-BUTANE HOSE FOR HANDLING LIQUEFIED PETROLEUM GASES
CONVEYOR BELTING • PIPE SLINGS • RUBBERLOKT® WIRE WHEEL BRUSHES

New Books, Maps and Movies

Drilling Mud Additives

"The Effects of Drilling Mud Additives on Oil Well Cements" (Bulletin D-4), a publication sponsored by the API Central Committee on Drilling and Production Practice, is a special report of the Mid-Continent District Study Committee on Cementing Practices and Testing Oil Well Cements. The 40-page report summarizes data obtained from a series of cooperative tests on the effect of several chemicals on the thickening time and strength of three types of commercial cement.

API Division of Production, 816 Rio Grande National Bank Building, Dallas 2.

New Mexico Record

A county-by-county tabulation of oil operations in one of the nation's most active oil centers is recorded in "Ira Rinehart's New Mexico Oil — 1951." A companion volume to "West Texas Oil — 1949," the new book extends the discussion of the Permian Basin to the area within the political confines of New Mexico.

Rinehart Oil News Company, P.O. Box 1208, Dallas. $15 to subscribers; $25 to non-subscribers.

Life of Marland

All the way up and all the way down, Ernest Whitworth Marland was fabulous both in success and in failure. His story is told in "Life and Death of an Oilman: The Career of E. W. Marland," a new book by John Joseph Mathews.

Although gifted (or burdened) with driving energy, dreaming, cleverness and a capacity for acquisitiveness—qualities of other imperialists of industry—Marland was a victim of his own humanity, Mathews believes. He found repeated success in oil strikes, and by the mid-twenties was established as one of Oklahoma's leading citizens and one of the nation's half-dozen great oil producers. He thereafter became a political power, and governor of his state —but his years of decline began, due in large part to his vanity and hedonism. He had foreseen the end of the Age of Freedom, those golden years for the strong and fearless, and he himself fell victim of financial struggle and political intrigue which were part of the end of an era.

The University of Oklahoma Press, Norman, Okla. $3.75.

Stainless Steel

"Stainless Steel Handbook," a 120-page volume, contains charts and tables to facilitate selection of the proper type of stainless for a specific application. Each type is discussed separately, with detailed information about heat treating, fabrication and special conditions in service.

Allegheny Ludlum Steel Corporation, 2020 Oliver Building, Pittsburgh 22. Free.

Growth of Steel Industry

The story of steel and the men who made it one of the nation's greatest industries is told in "Steel Serves the Nation," the elaborate 50th anniversary publication of United States Steel Corporation. A summary of the principal achievements and services of U. S. Steel since its formation in 1901, as well as a record of its present-day operations, the book is profusely illustrated with drawing and photographs.

Steel pioneers—Kelly, Bessemer, Carnegie, Schwab, Gary, Frick and Morgan—played dramatic roles in the transition from the Iron Age to the Steel Age. Oil and gas industries, which are among steel's best customers, have played an equally important part in the advancement of steel in later years.

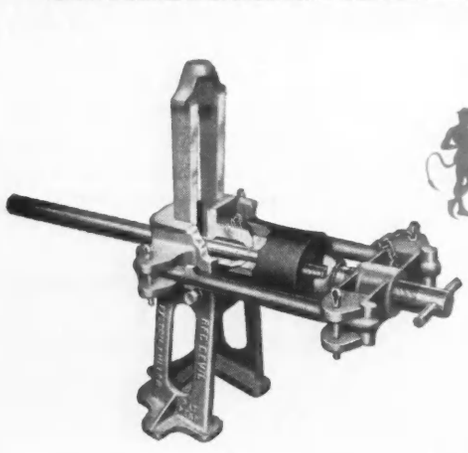
United States Steel Corporation, 71 Broadway, New York 6, N.Y. Limited edition, free.

RED DEVIL

"DIA-HARD" PISTON RODS

For high pressure abrasive service

RED DEVIL Piston Rods are first choice where drilling conditions are severest because of the extreme hardness of the deep HIGH-CARBON wear resistant "DIA-HARD" case, coupled with tough core properties which give the highest tensile strength against breakage. All rods are hardness tested and precision gauged to maintain a world-wide reputation for quality. Write for Catalog No. P-101.



RED DEVIL PISTON PULLER

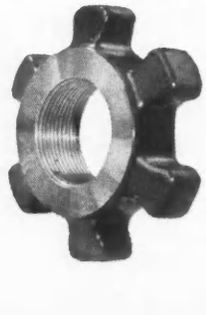
For tapered type rods

The usual practice of removing pistons from rods by blows of a sledge hammer often damages either pistons or rods. A Red Devil piston puller easily and quickly removes badly stuck pistons without injury to either part. All elements are made of finest quality alloy steel, heat-treated for strength and long life. Write for Catalog No. P-106.

RED DEVIL PISTON ROD LOCK NUT

These "Hammer Lug Type" nuts provide a fast and positive means for locking piston rod in crosshead. Made from alloy steel and heat treated, they will last indefinitely. Face of nut is precision machined for full seating surface at right angles to axis of threads to prevent fatigue stresses in rod. Write for Catalog P-102.

Complete information in Composite Catalog or write for price catalogs noted above. Red Devil products are available through your supply store.



OIL WELL MANUFACTURING CORP.

New Books

Biography of a Wildcatter

A big-rich roughneck, a ruthless emperor who created his own empire, Glenn H. McCarthy, "King of the Wildcatters," is the subject of Wallace Davis' straightforward, plain-spoken biography entitled "Corduroy Road."

The gossip and facts concerning the internationally famed oil man are presented in this account of the incredible career of McCarthy, an incorrigible plunger who gambles with millions as others play penny-ante poker.

Historically, McCarthy typifies the colorful, determined opportunism which built many of the Southwest's oil fortunes.

The Anson Jones Press, Houston. $5.

Minerals Yearbook

A new volume of the "Minerals Yearbook," a basic source of information on domestic and foreign mineral commodities, published annually by the Bureau of Mines, contains complete data for 1949, as well as comparative data for earlier years. New summary tables on domestic mineral production have been added to the current edition. The new national totals pertain exclusively to the production from domestic mines.

Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. $4.50.

BUSINESS OPPORTUNITIES

■ WANTED TO BUY: An Oil Corporation that has "lost its shirt" the last two years. Wire or phone us collect. Must be a corporation. Goodall Electric Mfg. Co., Ogallala, Nebraska.

WANTED TO DRILL IMMEDIATELY
A Lease That Is Off-set to Production.
Submit full details to Nelson B. Cramer, 2831 E. Ocean Boulevard, Long Beach 3, California

■ WE WILL BUY Producing Oil Royalties. Send Particulars. Standard Security Co., 111 Broadway, New York 6, New York.

SITUATION WANTED

Drilling contractor operating in West Texas and New Mexico desires to contact small or medium-sized independent oil company who needs an operating manager. Personal interview desired. Twenty years experience in all phases of the oil industry. Address replies to Box 94-W, WORLD OIL, Houston 1, Texas.

GEOLOGIST & MINING ENGINEER, lifelong experience, especially in the discovery of unknown oil & mineral stratas seeks temporary work. I am also **INVENTOR** of a new Drilling apparatus for cheaper and more rapid bore in infinite depth. Box 29-W, c/o WORLD OIL, Houston 1, Texas.

DECALS

TRUCK LETTERING AND TRADEMARK decals made for your trucks. Easy to apply, uniform, distinctive, economical for small or large needs. Write for Catalog. Mathews Company, 827 S. Harvey, Oak Park, Ill.

WORLD OIL'S Trading Post

CLASSIFIED ADS

SERVICES · PERSONNEL · USED EQUIPMENT

RATES: Regular Classified (undisplayed) set in this size type: 10 cents per word. If Box Number is to be used count an additional six words. Replies forwarded without charge. Situation Wanted: 5 cents per word. Display advertisements, set in suitably larger type with ruled border: $9.00 per column inch per insertion. Situation Wanted: $4.50 per column inch. All classified ads payable in advance. 10% Discount if 3 or more insertions are ordered at one time. COPY DEADLINE: 5th of month preceding date of issue. Send copy and checks to: Trading Post Section, World Oil, P. O. Box 2608, Houston, Texas.

FOR SALE

■ Well drills, spudders, rotaries, core-drills. All sizes new and used equipment. Tools, drill pipe, cable, pipe. Fishing tools rented. Everything for well drilling. Pressey & Son, Pueblo, Colorado.

5150 acres of fine cotton and maize land for sale, located in Dawson County, Texas, about 12 miles southwest of Lamesa, and all in cultivation. The Sunray recently completed a small well on and near the northeast corner of this land. It is all leased for oil and/or gas to major oil companies or large independent oil companies, except approximately 55 acres, which is unleased. Will sell the land and ¼ royalty; or the land without any mineral interests; or ¼ royalty, either term or perpetual and either participating or non-participating. Correspondence invited, and brokers protected.

W. J. CLAY,
701 W. T. Waggoner Bldg.,
Fort Worth, Texas.

■ FOR SALE: Used oil barges, excellent for conversion to drilling and material barges. Write Commercial Petroleum & Transport Co., 344 Esperson Building, Houston 2, Texas.

■ TWO 150 horsepower F and T boilers located at Eunice, New Mexico. Makin Drilling Co., Box 131, Hobbs, New Mexico.

■ 44 OIL FIELD Cyclone Churn Drill. Has only drilled 4000 ft. since purchased new. Mounted on 3 Ton International Truck; Truck in perfect shape. Good Tires all around. 700 ft. ¾ inch Cable. 400 ft. 7/16 inch Sand Line. Blower and Reverse gear attachment. Price, $5700. Kabele Bros., Platteville, Wisconsin.

FOR RENT

FOR RENT

P & H Model 955 ALC Combination Crane, Dragline & Clamshell; 90' boom; New 1950; A-1 condition. Usona Construction Company, 314 North Broadway, Telephone Central 3314, St. Louis 2, Missouri.

FOR SALE

FOR SALE

Pipe, Casing and Tubing

Our Nationwide facilities are at your disposal. For information call collect, Phone 26111, or write John Pickering, Petroleum Pipe & Equipment Company, P. O. Box 4245, Corpus Christi, Texas.

HELP WANTED

■ PETROLEUM ENGINEER or technologist for secondary recovery research laboratory in eastern United States. Advanced degree or production research experience preferred. Liberal publication policy. Opportunity to gain first hand experience in secondary recovery through coordinated laboratory and field research. Salary open. Reply giving educational background and experience. Box 30-W, c/o WORLD OIL, Houston, Texas.

GEOPHYSICAL FOREIGN SUPERVISOR, COMBINED GRAVITY AND MAGNETIC CREWS. Top salary. Ideal living conditions. Subsistence furnished. Transportation and expenses for family. Address: Box 24W, c/o WORLD OIL, Houston, Texas.

OIL AND GAS

In Western North Dakota and Northwestern South Dakota, I have a well selected spread of oil and gas leases, all of them running for approximately a ten year period. Correspondence invited, and brokers protected.

W. J. CLAY,
701 W. T. Waggoner Bldg.,
Fort Worth, Texas

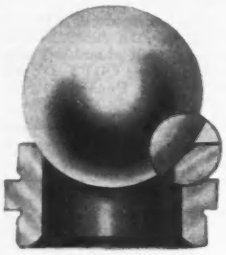
WANTED
RESEARCH ENGINEERS WITH FIELD EXPERIENCE

The Carter Oil Company's Research Laboratory at Tulsa is expanding its staff. Two engineers, with MS degrees and two to five years oil field experience, are needed. The work includes research in fundamentals of reservoir performance and secondary recovery, and involves application of newly developed reservoir engineering techniques in studies of foreign and domestic pools.

If you have research ability, the necessary experience, and a good scholastic background, write to:

CHIEF OF RESEARCH
THE CARTER OIL COMPANY
P. O. Box 801
Tulsa, Oklahoma

REDUCE "DOWN TIME"



Use BALLS and SEATS That Match Your Well Conditions

The performance of any pump depends upon the valves it uses. To help operators economically meet the many different well conditions under which oil well pumps operate O'Bannon offers eight kinds of balls and seats.

- **TUNGALLOY**
  For the really tough wells where abrasion, corrosion, impact, magnetism or all of these factors are severe. Made of a non-ferrous alloy so tough grinders must be used to form it.
- **CHROMALLOY**
  The "work horse" of our ball and seat line. Resistant to abrasion, impact and most forms of corrosion.
- **TRIPLE-X-ALLOY**
  A non-magnetic valve, highly resistant to corrosion, especially hydrogen sulphide.
- **TUNGALLEX**
  Combines a Tungalloy seat with a Triple-X-Alloy ball for conditions less severe than those which require Tungalloy throughout.
- **CHROMALLEX**
  Combining a Triple-X-Alloy ball with a Chromalloy seat this valve is non-magnetic, and gives better service than Triple-X-Alloy in hard pumping wells because of its tougher seat. Resists corrosion, but Triple-X-Alloy is better in hydrogen sulphide.
- **CHROM-BRONZE**
  A Chromalloy seat with a bronze ball. Resists corrosion and is immune to lodestone. Excellent for shallow wells where impact and abrasion are not troublesome.
- **STEELALLOY**
  A tough, wear-resistant valve for wells which are not corrosive.
- **STEEL BRONZE**
  A non-magnetic valve for average non-corrosive wells.

To reduce "Down Time" equip your pumps with O'Bannon Balls and Seats matched to the well conditions.

SOLD BY SUPPLY STORES

Walter O'Bannon Co.

Tulsa 1, Oklahoma

Crude Result

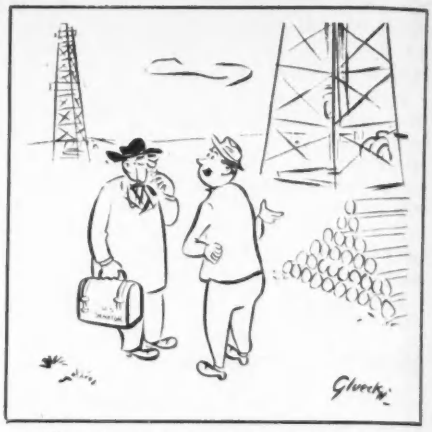
The oil industry, never missing an opportunity to glamorize its place in the sun, came up with this "pome" in connection with the selection of Miss Pat Seabeck of Casper for the title of "Miss Rocky Mountain Oil Capitol" at the Central Wyoming Fair. From the offices of General Petroleum Corporation came these verses:

What are pretty girls made of?
Sugar and spice
'N everything nice,
That's what pretty girls are made of!
What makes pretty girls lovelier?
Soap and shampoo,
'N hair-do, too,
Start to make pretty girls lovelier.
What do pretty girls dress in?
Sweaters and shorts
'N gowns of all sorts
The kind they show most "finesse" in.
What are these pretty things made of?
Petroleum wells
Supply the belles,
What these pretty things are made of.

Accord

"Do you think they approve of my sermon?" asked the newly-appointed pastor, hopeful he had made a good impression.

"Yes, I think so," replied his wife; "they were all nodding."



"When it comes to government interference there's nothing to compare with American skill and know-how!"

Economical, Family Size

The guest watched with amazement as the young son of the house amused himself by driving nails into the furniture. Recovering a bit from the shock, he turned to his host and asked: "Joe, isn't that an expensive pastime your son has? How can you afford it?"

"Oh, it's not bad," answered the father. "We get the nails wholesale."

This Pump GETS Going . . . STAYS Going In ALL Weather

It's WISCONSIN-Powered!

Sand storms or rain, cold weather or hot, this gathering pump delivers dependability at a Texas oil field. It's powered by a Wisconsin Heavy-Duty Air-Cooled Engine.

Wisconsin-powered units *get going* and *stay going* even with weather and climate against them because of such heavy-duty features as tapered roller bearings at both ends of the crankshaft, and an easily-serviced OUTSIDE magneto with impulse coupling for fast starting and steady going. And because Wisconsins are cooled by air alone, water stays where it belongs . . . no nearer than the weather brings it. The result is, more heavy-duty service *from* the engine, and less maintenance servicing *to* the engine, two factors *looked for* and *found* in Wisconsin Engines by oil producers and manufacturers everywhere.

4-cycle single-cylinder, 2-cylinder and V-type 4-cylinder models, 3 to 30 hp.

WISCONSIN MOTOR Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
619 S. MAIN STREET, TULSA, OKLAHOMA
M & M BUILDING, HOUSTON, TEXAS
505 SOUTH MAIN ST., WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS.

What's NEW

In Perforating, Testing, and Fishing Tool Services

McCULLOUGH®
NEW SERVICES • NEW TOOLS
NEW WAYS OF DOING THINGS

Latest News About New Tools, Techniques and Services

How You Get

MORE B/D

With McCullough—Still the World's Hardest Shooting Bullet and Jet Perforators!

MORE PRODUCTION, increased production, maximum production—this is the product of the hardest shooting Bullet and Jet Perforators in the world—McCullough!

Proof? Daily job reports from every major oil field (See a few typical jobs in the adjoining column) have one thing in common—MORE production, even after all other methods had failed!

HARDEST SHOOTING BULLETS

It is no secret that conical shaped, armor piercing bullets obtain the deepest penetration, but they also leave a large burr. An ogival pointed bullet also leaves a large burr, only the edges of the crater are rolled slightly.

McCullough by using the best features of both types of bullets developed the only practical Burrless Bullet. Deeper penetration and burrless holes are obtained by placing an ogival shaped alloy jacket over the end of a conical pointed bullet. The alloy jacket is consumed as it penetrates the first string of casing leaving the conical bullet to perforate the remaining strings, cement, and deeper into the formation.

In addition to more production, these burrless holes have saved probably a million dollars in scraping tools and rig time.

HARDEST SHOOTING JETS

McCullough Glass Jet Perforators are writing production history. New improvements in design have resulted in 75.9% greater penetration with 37.5% LESS explosives! Time after time they have substantially increased production after all other methods had failed. Equally effective in open hole, the smallest casing or the largest casing. Produce straighter, cleaner, carrot-slug free holes! In test after test concentrated power did not damage casing in any way.

ARE YOU INTERESTED?

You should be if you're drilling for oil! Call the McCullough Service Engineer in your area for free consultation on your perforating problems and typical results in wells near you. Call McCullough and make that well an outstanding producer!

Excerpts from a Few Typical
DAILY REPORTS
McCullough Tool Company

JOB DETAILS	RESULTS
1. Glenrock, Wyoming. Casing size: 5½"—17 lb. cemented in 9" hole. Tight and hard "Dakota" sand. Formerly jet perforated obtaining 62 B/D. McCullough Glass Jet Perforator shot 152 holes in 39 foot interval below 6,000 ft. Time on job—8½ hours.	**62 B/D to 372 B/D**
2. Olney, Texas. Casing size: 5½"—17 lb. cemented in 9" hole. Caddo lime formation. Formerly perforated without results. McCullough shot 120 Burrless Bullets in 30 foot interval around 5,000 feet. Time on job—2 hours.	**0 B/D to 100 B/D**
3. Ventura, California. Newest world record McCullough Gun Perforating job. 7620 Burrless Bullets shot with McCullough 90-shot Gun Perforator in 81½ hours!	**Very satisfactory (Actual figures not released)**
4. Cyril, Oklahoma. Open hole and through 7" casing. Formerly perforated obtaining 210 B/D. McCullough Glass Jet Perforator shot 600 holes around 6,000 feet. Time on job—11 hours.	**210 B/D to 676 B/D**
5. Eunice, New Mexico. Casing size: 5½"—17 lb., lime formation. New Well. McCullough Glass Jet Perforator shot 312 holes in 100 foot interval around 8,000 feet. Time on job—7 hours.	**0 B/D to 1520 B/D**
6. Ventura, California. Squeeze job. McCullough 3" Glass Jet Perforator. Casing size: 11¾", 20", set in 26" hole. Total of 7" penetration necessary, through 1" of steel and 6" of cement, mud and formation.	**Satisfactory squeeze job**

PERFORATING, TESTING AND FISHING SERVICE ANYWHERE — ANYTIME!

McCULLOUGH TOOL COMPANY
5820 South Alameda Street, Los Angeles 58, California
405 McCarty Street (P.O. Box 2575) • Houston, Texas
CANADA: Edmonton, Alberta • **EXPORT OFFICE:** Los Angeles, California
VENEZUELA: United Oilwell Service Co., S.A.; Caracas, Anaco, Maracaibo

SERVICE LOCATIONS: **TEXAS:** Houston, Snyder, Alice, Cisco, Corpus Christi, McAllen, Odessa, Tyler, San Angelo, Victoria, Wichita Falls. **OKLAHOMA:** Oklahoma City, Guymon, Healdton. **MISSISSIPPI:** Laurel. **NEW MEXICO:** Hobbs. **KANSAS:** Great Bend. **WYOMING:** Casper: **CALIFORNIA:** Los Angeles, Avenal, Bakersfield, Ventura. **LOUISIANA:** Houma, Lake Charles, New Iberia, Shreveport. **COLORADO:** Sterling.

Mid-Continent NEWS and HUMOR?

We've 2 New Stores . . .

and SAM WORRALL, our Store Manager at Sterling, Colorado, is mighty proud of his shiny new Rocky Mountain home (above). Sam says, "We're fully stocked and staffed and are operating 24-hours-a-day." . . . and FRED BURGE, our Natchez, Mississippi, Store Manager, reports that our new deep south outpost is also open "Around-the-Clock" to provide those famous products and services to our Southern friends.

You can get your Mid-Continent NEWS when you visit these stores.

MID-CONTINENT
Supply Company
General Offices Mid-Continent Bldg. FORT WORTH, TEXAS

SQUEAKS FROM THE BULLWHEEL

The Military Mind

The colonel was lecturing a class of incipient officers. "A 40-foot flagpole has fallen down," he said. "You have a sergeant and a squad of ten men. How do you erect the flagpole again?"

The candidates thought, then made suggestions about block-and-tackle, derricks and so on.

"You're all wrong," said the colonel. "You'd say: 'Sergeant, get that flagpole up!' "

Music Lovers

A man met a friend on the street, all bandaged up and walking on crutches. "What happened?" asked the friend.

"Well, I had a date with my girl and we were dancing to the music of the radio, and you know how deaf her old man is."

Ground Rules

"How would you like to sign up with me for a life game?" was the way a baseball fan proposed.

"I'm agreeable," replied the girl. "Where's your diamond?"

Annie Up

Joe and Ann had been amicably married for five years when arriving home earlier than usual, Joe found his wife in the arms of his best friend. "I love your wife and she loves me," said the friend. "I'll play you a game of cards for her. If I win, you divorce her, and if you win, I promise never to see Ann again. How about gin rummy?"

"All right," agreed Joe, "but how about a penny a point just to make the game interesting?"

Decent Folk

Ma: "Clem, you've jest got to buy me some clothes! Purty soon, I'll not have nary a stitch to wear; then what'll I do?"

Pa: "Pull down the shades. We cain't be a-scarin' the neighbors."

Native Custom

The train for Washington had just pulled out of Norfolk and the passengers had settled themselves for the journey, when a tall and dignified man presented himself in the club car, and addressing the passengers, asked, "Is theah a gentleman from Albemarle County present?"

One man stood up and stated he was a native of that county.

"Fine," beamed the first man. "I wondah if Ah might borrow youah co'kscrew fo' a minute?"

Distinction

The lecturer was trying to make a telling illustration: "If I brought a donkey a pail of water and a pail of beer, which would he drink?"

"The water," came a woman's voice from the front row.

"And why would he take the water?" asked the lecturer.

"Because he's a stupid ass," came a man's voice from the rear.

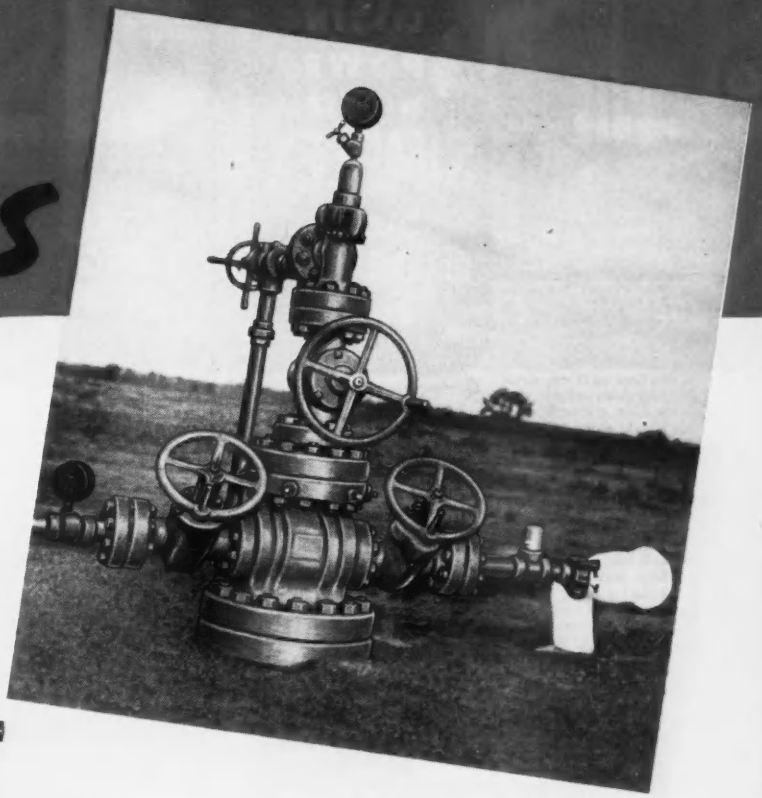
Sufficient Unto the Needs Thereof

"What kind of a saddle do you want?" the cowboy asked the Dude. "With or without a horn?"

The Dude pondered a moment before answering: "Without one, I guess. Doesn't seem to be much traffic on these prairies."

HINDERLITER

TYPE XF TUBING HEADS



The complete line of Hinderliter Tubing Heads comprises types to fit every production problem from high pressure flowing to pumping wells. The type XF high pressure full opening Tubing Heads illustrated are designed for use where processes require suspension of well tubing by the hanger method.

The type XF Head is the basic unit which allows the running and pulling of tubing while in the process of drilling-in, coring, testing or where other methods of completion are necessary.

Type XF Tubing Heads are available in a wide range of sizes in test pressures from 2000 lbs. to 10,000 lbs. Bottom connection and outlets are threaded or flanged, to customers specifications. Top flanges are A. P. I. and adaptable for use with flanged mating members such as valves and ram type blowout preventers. Their use is particularly advantageous in multiple zone completions.

For Complete Specifications Write for Bulletin No. W-401

At Your SUPPLY STORES

HINDERLITER PORTER "Better Built" EQUIPMENT

HINDERLITER TOOL COMPANY DIVISION

H. K. PORTER COMPANY, INC.

TULSA 1, OKLAHOMA **DRAWER 2650**

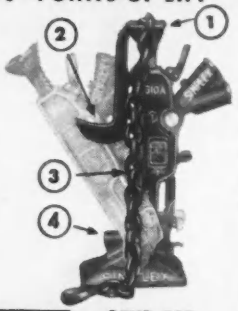
4-WAY LIFTING POWER with this SIMPLEX 310-A EMERGENCY JACK

Powerful 310-A Simplex EMERGENCY JACK is easy operating, will lift vertically or push or lift in any position.

"Get the Simplex" is the call on drilling jobs when men want quick, safe jack action. The double lever socket enables them to work in close quarters and at any angle.

This 15-ton Ratchet Lowering jack will lift or lower from four points—on the rotary cap, on the auxiliary cap shoe, on the serrated toe lift, or from any intermediate height by using the chain as a sling.

4 "POINTS OF LIFT"



Simplex LEVER • SCREW • HYDRAULIC Jacks

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TEMPLETON, KENLY & CO.
1032 S. Central Ave., Chicago 44, Ill.

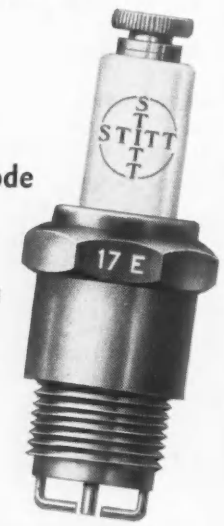
STITT

the *Standard Gas* Engine

Spark Plug

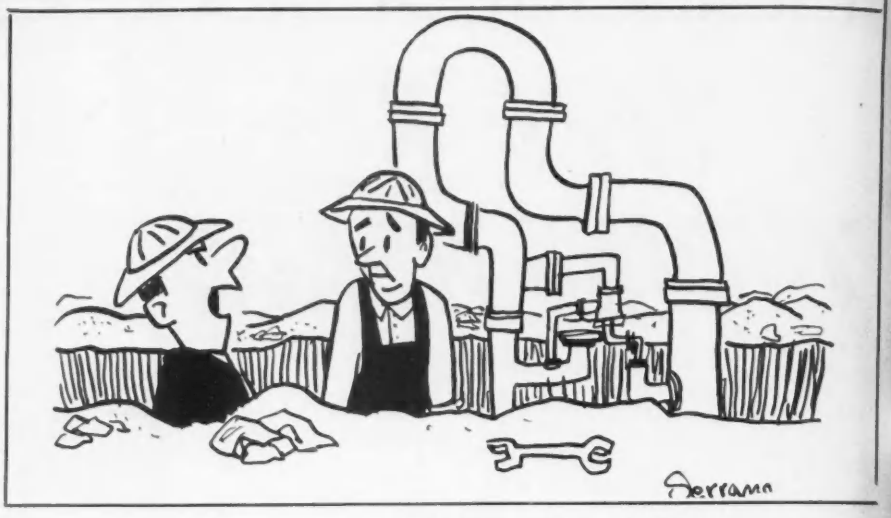
SINCE 1918

- ★ Improved Insulation
- ★ Long Electrode Life
- ★ One-Piece Construction
- ★ Non-Fouling
- ★ Pressure Seal



At Your Supply Store!

SQUEAKS FROM THE BULLWHEEL



"It's not necessary to use all the spare fittings, Hendrix!"

The Children's Hour

A tourist came upon a small boy sitting on a rail fence by the side of the road and watching a great red glow in the western sky.

"My boy," he said enthusiastically, "I am glad to see that you appreciate the beauties of nature."

"Yes, sir."

"There is nothing that equals a beautiful sunset," pursued the tourist. "Do you come here often to watch it?"

"That ain't no settin' sun!" replied the boy, turning a beaming countenance toward the other. "That's our school house burning down."

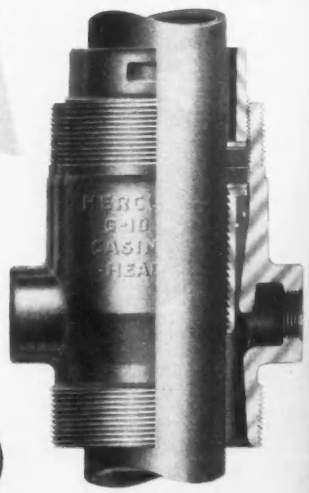
Permanent Cure

We heard a tale the other day about a fellow who told his doctor that he didn't want to get well because he was in love with his nurse.

He didn't. She was the doctor's wife.

STANDARD of the INDUSTRY...

"Originators of overhead-packed wellhead equipment"



The next time you order, be sure to specify HERCULES G-10 CASING HEADS—standard of the industry for 26 years. Made from electric cast steel, with overhead packing arrangement and built to stand 3,000 pounds test pressure. Steps are provided to support from 2" tubing up to and including 7" casing. Will safely support 10,000 feet of 7" O.D. Casing.

Write for Bulletin No. 310-G10

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The Right Bits When You Need Them!

It's no accident that your local Hughes field representative delivers the *right rock bits on your rig at the right time!*

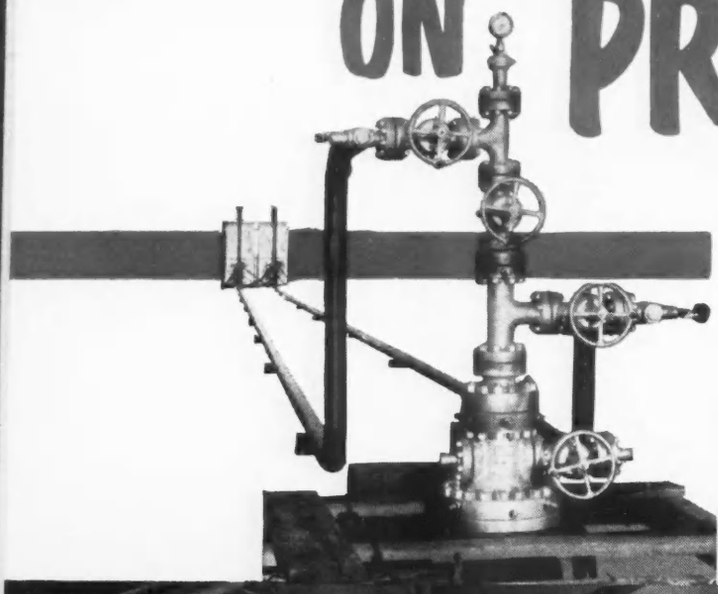
The effort of the entire Hughes organization is directed toward knowing, in advance, the bit requirements of each field, in order to set up manufacturing schedules to meet those requirements.

This means knowing the types and sizes of bits needed and approximately when they will be required, based on the casing sizes in general use and likely to be used...formations being encountered ...bits making the best footage...and the depth and number of wells to be drilled.

This information comes from many sources. Its accuracy is made possible by the co-operation of every segment of the drilling and producing industry and accounts for the fact that the Hughes Tool Company is able to anticipate the bit needs of the industry.

HUGHES Tri-Cone ROCK BITS

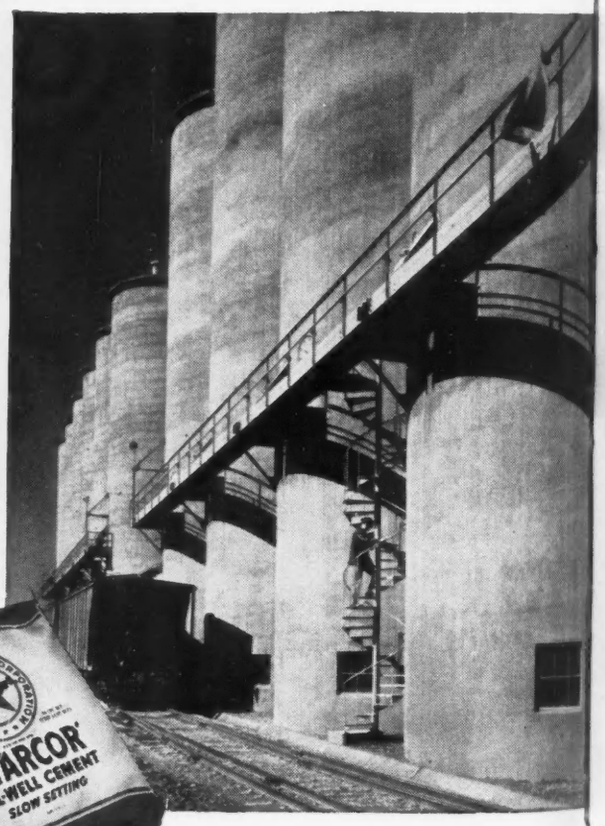
ON PRODUCTION



● "Christmas tree", flow lines and tanks... signal that the well is "on production" . . . oil starting on its long journey to the ultimate consumer.

"On production" at the cement plant is typified by the huge, concrete storage silos, each holding 40,000 sacks of cement...by the bulk cement flowing from the silo to the special covered railroad car...by the packing machines filling sacks for loading into boxcars.

Each brand or type of cement has its own storage silos and packing machine...quality cements to meet the varied requirements of the oil fields.



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